United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with
Iowa Agriculture and
Home Economics
Experiment Station;
Cooperative Extension
Service, Iowa State
University; and Division of
Soil Conservation, Iowa
Department of Agriculture
and Land Stewardship

Soil Survey of Lucas County, Iowa

Part I

How to Use This Soil Survey

This survey is divided into three parts. Part I includes general information about the survey area; descriptions of the general soil map units, detailed soil map units, and soil series in the area; and a description of how the soils formed. Part II describes the use and management of the soils and the major soil properties. This part may be updated as further information about soil management becomes available. Part III includes the maps.

On the **general soil map**, the survey area is divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** in Part I of this survey for a general description of the soils in your area.

The **detailed soil maps** can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**. Note the number of the map sheet, and turn to that sheet.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** in Part I of this survey, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** in Part II shows which table has data on a specific land use for each detailed soil map unit. See the **Contents** in Part I and Part II for other sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1990. Soil names and descriptions were approved in 1991. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1990. This survey was made cooperatively by the Natural Resources Conservation Service; the Iowa Agriculture and Home Economics Experiment Station; the Cooperative Extension Service, Iowa State University; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship. The survey is part of the technical assistance furnished to the Lucas County Soil and Water Conservation District. Funds appropriated by Lucas County were used to defray part of the cost of the survey.

Cover: A typical area of Gara and Pershing soils in Red Haw State Park.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service home page on the World Wide Web. The address is http://www.nrcs.usda.gov (click on "Technical Resources").

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Foreword

This soil survey contains information that can be used in land-planning programs in Lucas County, Iowa. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Leroy Brown, Jr.
State Conservationist
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Soil Survey of
Lucas County, Iowa

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Fieldwork by Asghar A. Chowdhery, Stephen J. Ernst, James M. Gertsma, Gary L. Hilmer, and Gary L. Lindgren, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with
the Iowa Agriculture and Home Economics Experiment Station; the Cooperative Extension Service, Iowa State University; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, soil scientists develop a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientists to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge into one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size, and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, soil reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

This soil survey updates the survey of Lucas County, Iowa, published in 1960 (Benton and Prill, 1960). It provides additional information and has larger maps, which show the soils in greater detail.

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

General Nature of the Survey Area

Lucas County is in south-central Iowa (fig. 1). It has an area of 278,300 acres, or 435 square miles. Chariton is the county seat. It is near the center of the county, about 53 miles southeast of Des Moines.

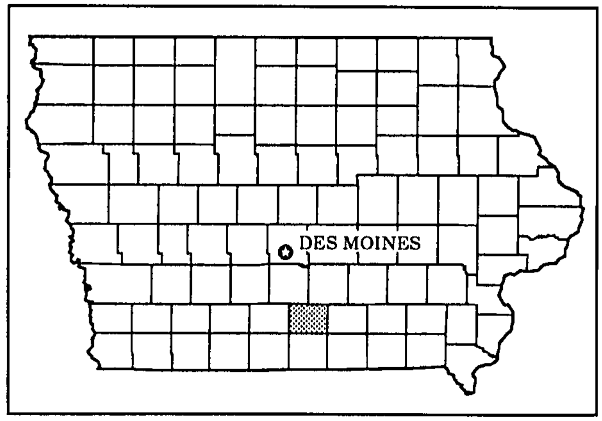

Figure 1.—Location of Lucas County in Iowa.

Much of the acreage in the county is farmland that is used mainly for corn, soybeans, oats, hay, and pasture. A small acreage, mainly around Whitebreast Creek, North Cedar Creek, and the Chariton River, is used as woodland. Corn and soybeans are the main grain crops. Raising livestock, principally hogs and beef, is also an important enterprise.

History

The first inhabitants of the survey area were the Sac and Fox tribes of the Iowan Indians. In 1843, the area was ceded to the United States for settlement. In 1846, by an act of the Territorial Legislature, it was established as a county. It was named in honor of Robert Lucas, the first Territorial Governor of Iowa (History of Lucas County, 1881).

During the fall of 1846, a few Mormon families settled in an area about 1½ miles southeast of the present-day town of Chariton. They planted crops and lived there for about 2 years. This settlement was later called Chariton Point. The route the Mormons took when they left the county is known as the Mormon Trail Road. It was the terminal for the stage line. Chariton was named after a French trader who established a trading post at the spot where the Chariton River flows into the Missouri River.

The organization of Lucas County government began at Chariton Point in July 1840. In August of 1849, the county seat of Lucas County was established. It was named Polk after President Polk, but the name was later changed to Chariton.

The first permanent settler in Lucas County settled in Cedar Township in the spring of 1847. In 1852, LaGrange was established 11 miles east of Chariton, along the route of U.S. Highway 34. LaGrange was larger than Chariton and served as a stagecoach stop for several years.

When the railroad was constructed in Lucas County in 1867, the towns of Derby, Russell, Oakley, and Lucas were established. Because the railroad was located 2 miles south of the stagecoach route, LaGrange declined and eventually disappeared. With the development of the railroad, the coal mining industry emerged in 1874. Most of the mining occurred in Pleasant Township and near the town of Lucas. John L. Lewis, who later was president of the United Mine Workers of America for 40 years, was born in Lucas in 1880. This town had the distinction of having the first light bulb to be turned on in the State of Iowa. The light bulb was used in a mine, east of Lucas. There were about seven mining camp towns during the years from 1874 through 1930. The largest of these camps were Tipperary and Olmitz. Currently, there is strip mining in the northeastern part of the county.

The first census of the county was taken in 1870. The population increased by nearly 50 percent during the period from 1870 to 1900. Since then, it has been gradually decreasing. It was 6,250 in 1980. The urban population increased significantly from 1885 to 1940 but has steadily declined since that period.

Farming

The recent trend in the county has been toward a decrease in the number of farms and an increase in the average size of farms. In 1989, there were 680 farms in the county and the average farm size was 369 acres (Iowa Agriculture Statistics, 1990).

Agriculture in the county centers on grain and livestock production. In 1986, corn was planted on 45,000 acres. Of this total, 42,400 acres was harvested for grain and 2,300 acres was used for silage. The average corn grain yield was 117.8 bushels per acre. Hay was grown on 43,100 acres. Soybeans were grown on 27,500 acres, and all but 1,000 acres of this total was harvested for beans. About 11,300 acres was used for oats, and 800 acres was used for wheat.

In 1986, about 74,000 hogs were marketed (Iowa Agriculture Statistics, 1987). The county had 40,000 cows and calves on farms and marketed 3,000 grain-fed beef cattle. There were 600 milk cows on farms. About 4,300 sheep and lambs were on the farms, and 5,600 were marketed.

Natural Resources

Soil is the most important natural resource in the county. It provides a growing medium for marketable crops and for the grass grazed by livestock. Another important resource is a limestone quarry, which is in the southern part of the county.

In most years the water supply in Lucas County is adequate for domestic use and for watering livestock. Glacial till and alluvium are the water-bearing sources for shallow wells. Glacial till aquifers are not always reliable because the soils are somewhat impermeable and rainfall tends to run off rather than be absorbed into the ground. Alluvial aquifers are shallow and are dependent on the local rainfall for recharge, and climatic records show patterns of spotty rainfall. Deeper glacial aquifers and bedrock aquifers at a depth of a few hundred feet are highly mineralized. Wells should be monitored periodically for ground-water pollutants. Chariton obtains its water supply from Lake Morris and Ellis City reservoirs. Approximately one-sixth of the county is served by rural water that is supplied by the Rathbun reservoir in Appanoose County to the southeast. Water for livestock is mainly supplied from farm ponds and active running streams.

Wildlife is also a resource in Lucas County. The survey area offers hunting of ring-necked pheasant, bobwhite quail, waterfowl, turkey, squirrel, rabbit, coyote, raccoon, and white-tailed deer. The many farm ponds support bass, bluegills, crappie, catfish, and bullhead, and streams are inhabited by catfish. Furbearing animals are trapped along drainageways and creeks. The county has 2,320 acres of state-owned wildlife areas.

Transportation Facilities

Three major highways serve Lucas County. U.S. Highway 34 traverses the county from east to west, and State Highway 14 runs north and south. These two highways intersect at Chariton. U.S. Highway 65 traverses the north and south and intersects U.S. Highway 34 at the western edge of Lucas. Hard-surfaced county roads connect these highways to the smaller communities in the county. All farms are along farm-to-market roads surfaced with crushed limestone. There are a few miles of unimproved, unsurfaced roads throughout the county. The major county roads are well distributed throughout the county.

Other transportation facilities include a double-track railroad, which crosses the county from east to west through Russell, Chariton, and Lucas, and a single-track railroad, which crosses the central part of the county from north to south through Chariton and Williamson. A municipal airport is 2 miles west of

Chariton. Scheduled airline transportation is available in Des Moines, which is about 50 miles away. Motor freight lines serve every trading center in the county.

Physiography, Drainage, and Geology

Lucas County is part of an extensive broad glacial drift plain mantled with loess. The landscape has been modified and altered by the action of streams and their tributaries cutting headward into the divides. The cutting has given the county the broken appearance characteristic of south-central Iowa.

Relief ranges from nearly level to very steep. The topography is characterized by rolling to very steep areas along streams and major drainageways, nearly level to gently rolling upland divides that have retained much of the original surface character, and narrow strips of nearly level flood plains that border most of the creeks and streams.

The northern and northeastern parts of the county are more dissected than the southwestern part. Therefore, the maximum amount of relief is in the northeastern part of the county and the most extensive dissected upland areas are in the western, northern, and northeastern parts.

Lucas County is divided into the Mississippi and Missouri River watersheds, as is indicated by the topographic feature on the upland divide that extends in an east-west direction across the southern part of the county. The elevation of the eastern half of the divide is about the same from the town of Chariton to the eastern side of the county. From Chariton towards the western side of the county, the elevation on this divide increases slightly with distance. Generally, the side slopes of the valley walls along the north side of a major drainage system that flows from east to west are gently sloping, and the side slopes of the valley walls along the south side are steeper.

The valley bottoms are 80 to 160 feet lower than the top of the adjacent upland divides along major drainageways. The highest elevation in the county is 1,106 feet above sea level. This point is about 3 miles southwest of Derby and is near the southwest corner of the county. The lowest elevation is in the northeast corner of the county, where Corruthers Creek flows into Monroe County. It is about 770 feet above sea level. Through the Des Moines River drainage system, the Mississippi River eventually receives about 68 percent of the runoff in Lucas County. The remaining runoff from the southern one-third of the county extending from west to east drains into the Chariton River and eventually into the Missouri River. Whitebreast and Little Whitebreast Creeks flow northerly. These creeks drain nearly all of the areas west and north of Chariton. South Otter Creek, which flows east and north, drains the northwestern part of the county. The runoff from the east-central and northeastern parts of the county flows into Corruthers, English, North Cedar, and White Creeks. All of these tributaries flow eventually into the Des Moines River. Wolf Creek, in the extreme south-central part of the county, and Honey Creek, in the extreme southeastern part of the county, flow into the Chariton River.

Climate

The three tables at the end of this section provide climate data for the survey area as recorded at Chariton in the period 1961 to 1990.

In winter, the average temperature is about 24 degrees F and the average daily minimum temperature is about 14 degrees. The lowest temperature on record, which occurred at Chariton on March 1, 1962, is -32 degrees. In summer, the average temperature is 73 degrees. The highest recorded temperature, which occurred at Chariton on July 27, 1956, is 106 degrees.

Growing degree days are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 37 inches. Of this, 26 inches, or 70 percent, usually falls in April through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 8 inches at Chariton on August 13, 1961. Thunderstorms occur on about 49 days each year, and most occur in June.

The average seasonal snowfall is about 27 inches. The greatest snow depth at any one time during the period of record was 24 inches. On the average, 10 days of the year have at least 1 inch of snow on the ground. The heaviest 1-day snowfall on record was 12 inches.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 79 percent. The sun shines 70 percent of the time possible in summer and 51 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 13 miles per hour, in April.

Temperature and Precipitation

(Recorded in the period 1961-90 at Chariton, Iowa)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	31.7	10.9	21.3	58	-22	6	0.96	0.32	1.49	2	7.0
February----	37.0	15.5	26.2	66	-20	17	1.08	.49	1.59	3	6.3
March-------	49.5	27.5	38.5	80	-3	122	2.33	.96	3.49	4	4.7
April-------	64.1	39.1	51.6	87	15	364	3.54	1.92	4.97	6	1.8
May---------	74.2	49.2	61.7	90	29	671	4.03	2.41	5.48	7	.0
June--------	82.8	58.4	70.6	96	40	908	4.82	2.52	6.84	7	.0
July--------	87.6	63.3	75.5	99	45	1,095	4.48	1.78	6.75	6	.0
August------	85.3	60.5	72.9	99	43	1,020	4.08	1.82	6.02	6	.0
September---	77.4	52.5	64.9	93	30	748	4.95	2.28	7.24	6	.0
October-----	66.6	40.9	53.7	87	18	433	2.98	1.10	4.55	5	.1
November----	50.5	29.4	39.9	74	3	119	2.16	.54	3.44	4	1.8
December----	35.4	16.4	25.9	64	-16	16	1.36	.61	2.00	3	5.6
Yearly:											
Average---	61.8	38.6	50.2	---	---	---	---	---	---	---	---
Extreme---	---	---	---	100	-25	---	---	---	---	---	---
Total-----	---	---	---	---	---	5,519	36.78	29.75	42.82	59	27.4

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

Freeze Dates in Spring and Fall

(Recorded in the period 1961-90 at Chariton, Iowa)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 21	May 3	May 15
2 years in 10 later than--	Apr. 16	Apr. 28	May 10
5 years in 10 later than--	Apr. 8	Apr. 19	May 1
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 6	Sept. 27	Sept. 19
2 years in 10 earlier than--	Oct. 12	Oct. 3	Sept. 23
5 years in 10 earlier than--	Oct. 23	Oct. 14	Oct. 2

Growing Season

(Recorded in the period 1961-90 at Chariton, Iowa)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	178	157	138
8 years in 10	184	163	143
5 years in 10	197	176	153
2 years in 10	210	189	164
1 year in 10	216	196	169

General Soil Map Units

The general soil map in this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The soils or miscellaneous areas making up one unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils or miscellaneous areas can be identified on the map. Likewise, areas that are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

1. Grundy-Haig-Arispe Association

Setting

Landform: Uplands
Slope range: 0 to 9 percent

Composition

Percent of survey area: 5
Extent of components in the association (fig. 2):
Grundy soils—42 percent
Haig soils—28 percent
Arispe soils—23 percent
Soils of minor extent—7 percent

Soil Characteristics

Grundy

Drainage class: Somewhat poorly drained
Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Shoulders and summits
Slope: 2 to 5 percent
Parent material: Loess

Haig

Drainage class: Poorly drained
Landform: Upland flats
Geomorphic component: Divides
Hillslope position: Summits
Slope: 0 to 2 percent
Parent material: Loess

Arispe

Drainage class: Somewhat poorly drained
Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent
Parent material: Loess and glacial till

Minor Soils

- Clarinda and similar soils
- Edina and similar soils
- Very poorly drained soils in shallow depressions

Major Uses

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

2. Arispe-Lamoni-Shelby Association

Setting

Landform: Uplands
Slope range: 5 to 25 percent

Composition

Percent of survey area: 30
Extent of components in the association (fig. 3):
Arispe soils—27 percent
Lamoni soils—14 percent

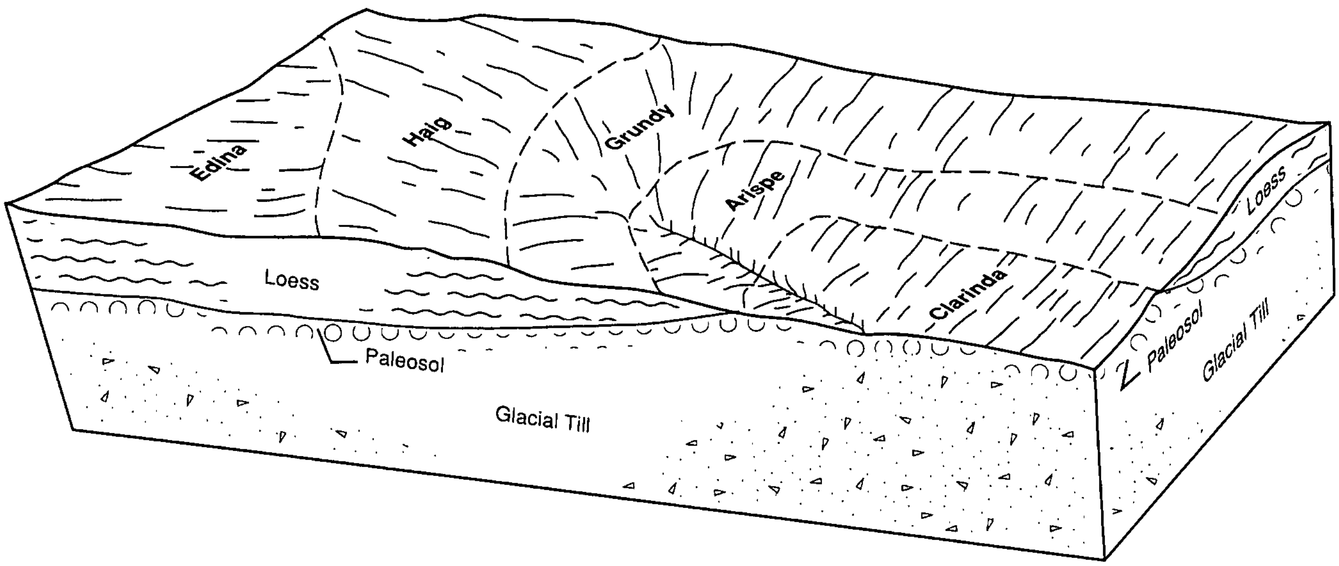

Figure 2.—Typical pattern of soils and parent material in the Grundy-Haig-Arispe association.

Shelby soils—13 percent
Soils of minor extent—46 percent

Soil Characteristics

Arispe

Drainage class: Somewhat poorly drained
Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent
Parent material: Loess

Lamoni

Drainage class: Somewhat poorly drained
Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 5 to 14 percent
Parent material: Gray paleosol weathered from glacial till

Shelby

Drainage class: Well drained
Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 25 percent
Parent material: Glacial till

Minor Soils

- Haig and similar soils
- Grundy and similar soils
- Clarinda and similar soils
- Adair and similar soils
- Zook and similar soils
- Olmitz and similar soils
- Vesser and similar soils

Major Uses

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

3. Gara-Pershing-Armstrong Association

Setting

Landform: Uplands
Slope range: 2 to 40 percent

Composition

Percent of survey area: 50
Extent of components in the association (fig. 4):
Gara soils—27 percent
Pershing soils—17 percent
Armstrong soils—17 percent

Soils of minor extent—39 percent

Soil Characteristics

Gara

Drainage class: Well drained
Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 40 percent
Parent material: Glacial till

Pershing

Drainage class: Somewhat poorly drained
Landform: Uplands and stream terraces
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 14 percent
Parent material: Loess

Armstrong

Drainage class: Moderately well drained
Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 5 to 14 percent
Parent material: Red paleosol weathered from glacial till

Minor Soils

- Bucknell and similar soils
- Grundy and similar soils
- Mystic and similar soils
- Vesser and similar soils
- Zook and similar soils
- Olmitz and similar soils

Major Uses

- Cropland
- Hayland
- Pasture

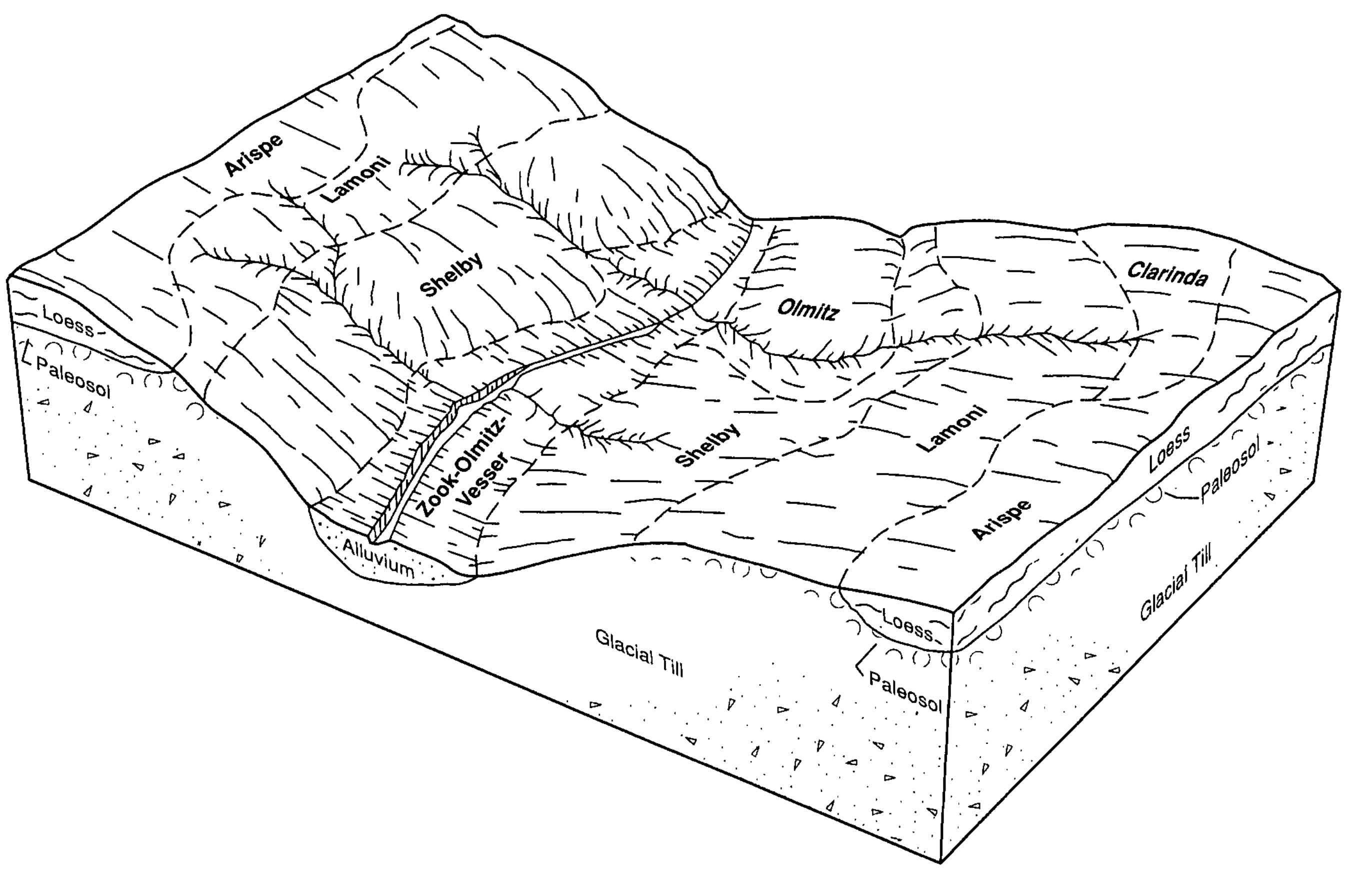

Figure 3.—Typical pattern of soils and parent material in the Arispe-Lamoni-Shelby association.

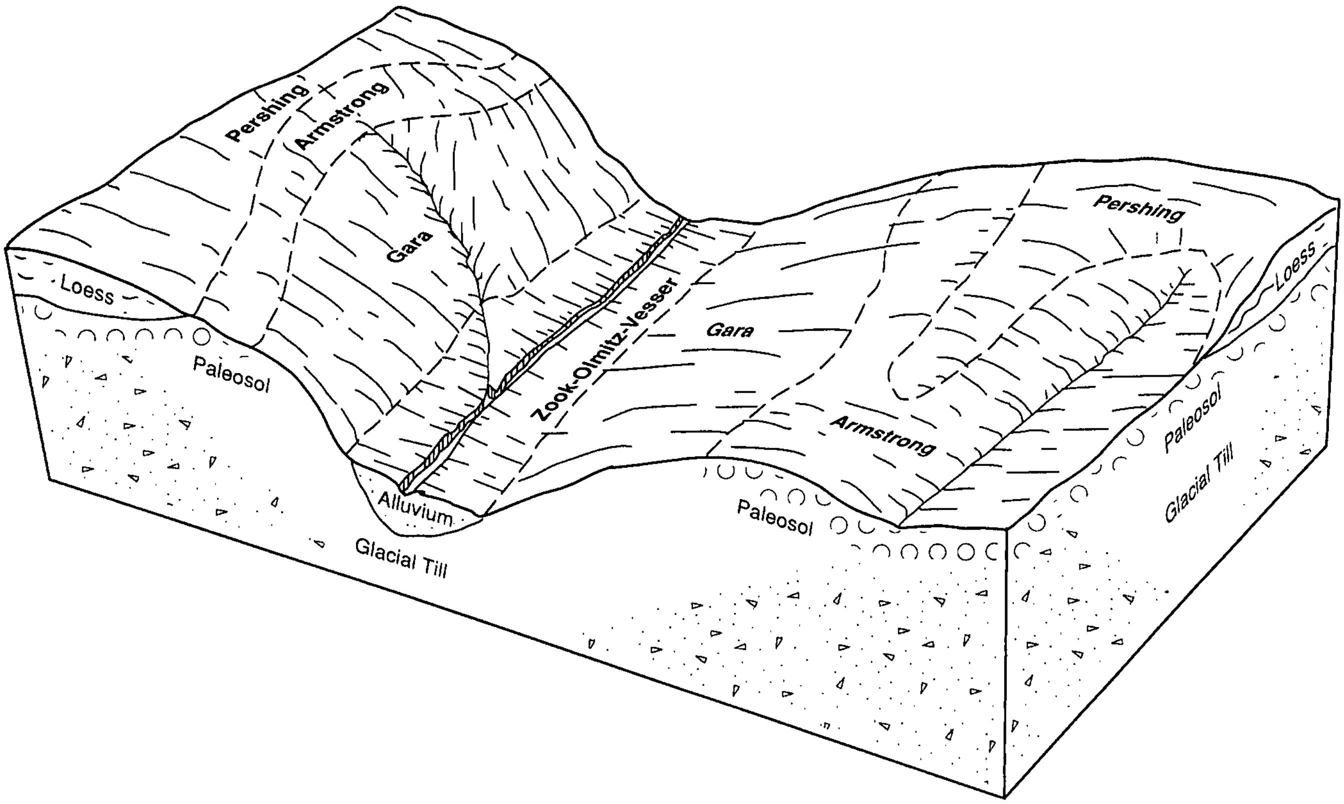

Figure 4.—Typical pattern of soils and parent material in the Gara-Pershing-Armstrong association.

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

4. Lindley-Keswick-Weller Association

Setting

Landform: Uplands
Slope range: 2 to 40 percent

Composition

Percent of survey area: 9
Extent of components in the association (fig. 5):
Lindley soils—34 percent
Keswick soils—24 percent
Weller soils—13 percent
Soils of minor extent—29 percent

Soil Characteristics

Lindley

Drainage class: Well drained
Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 40 percent
Parent material: Glacial till

Keswick

Drainage class: Moderately well drained
Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 5 to 14 percent
Parent material: Red paleosol

Weller

Drainage class: Moderately well drained
Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 14 percent
Parent material: Loess

Minor Soils

- Gosport and similar soils
- Nodaway and similar soils
- Vesser and similar soils

Major Uses

- Pasture
- Hayland
- Woodland
- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Woodland section
- Wildlife Habitat section

5. Nodaway-Zook-Lawson Association

Setting

Landform: Flood plains
Slope range: 0 to 2 percent

Composition

Percent of survey area: 6

Extent of components in the association:
Nodaway soils—38 percent
Zook soils—27 percent
Lawson soils—10 percent
Soils of minor extent—25 percent

Soil Characteristics

Nodaway

Drainage class: Moderately well drained
Landform: Flood plains
Slope: 0 to 2 percent
Parent material: Alluvium

Zook

Drainage class: Poorly drained
Landform: Flood plains
Slope: 0 to 2 percent
Parent material: Alluvium

Lawson

Drainage class: Somewhat poorly drained
Landform: Flood plains
Slope: 0 to 2 percent
Parent material: Alluvium

Minor Soils

- Ackmore and similar soils

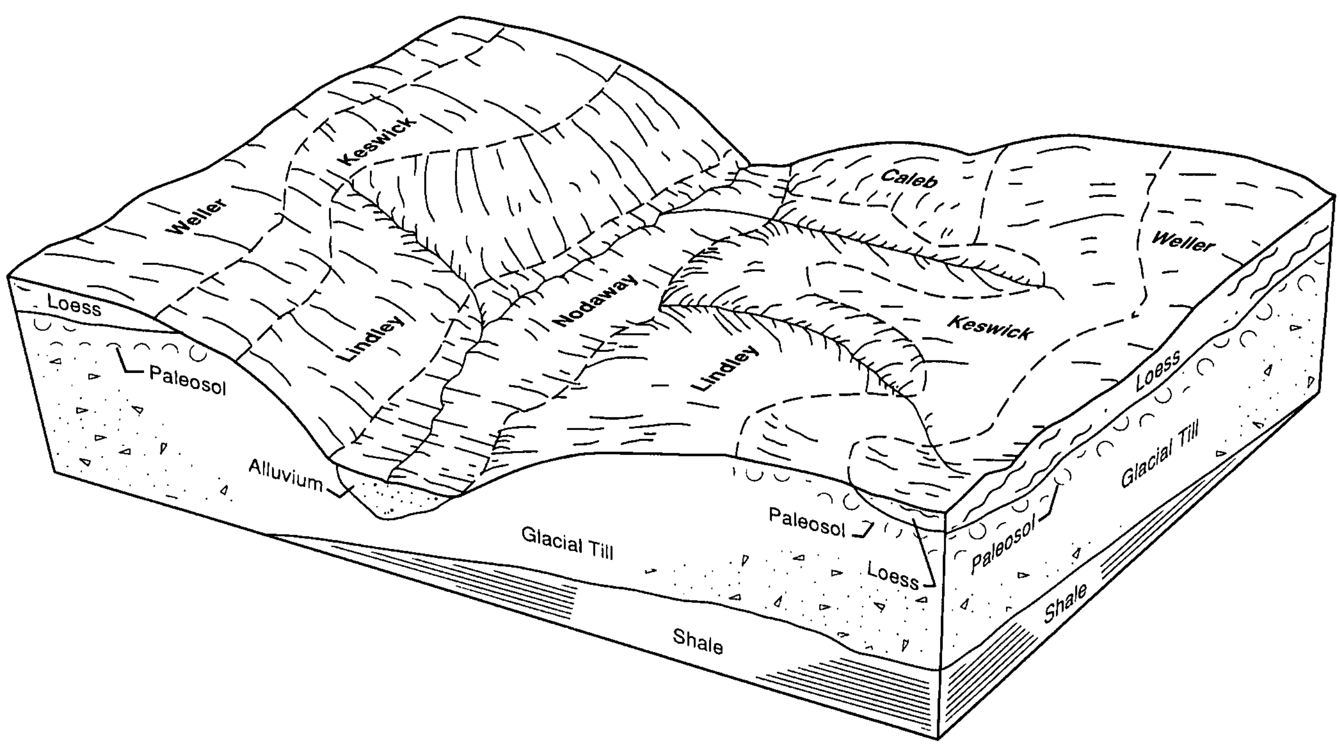

Figure 5.—Typical pattern of soils and parent material in the Lindley-Keswick-Weller association.

- Chequest and similar soils
- Humeston and similar soils
- Vesser and similar soils

Major Uses

- Cropland
- Pasture
- Woodland
- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Woodland section
- Wildlife Habitat section

Formation and Classification of the Soils

This section relates the soils in the survey area to the major factors of soil formation and describes the system of soil classification.

Formation of the Soils

The factors of soil formation and their effect on the soils in Lucas County are described in this section. The processes of soil formation that result in the formation of soil horizons are also described. Detailed descriptions of profiles typical of the series are given in the section "Soil Series and Detailed Soil Map Units."

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, and the length of time that the forces of soil formation have acted on the soil material (Jenny, 1941). Human activities also affect soil formation.

Climate and vegetation are the active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Some time is always needed for horizon differentiation. A long period generally is needed for the formation of distinct horizons. The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the others.

Climate

The soils in Lucas County formed under the influence of a midcontinental climate for at least 3,000 years (Ruhe, 1956b). The morphology and properties of most of the soils indicate that this climate was similar to the present climate. Between 30,000 and 11,000 years ago, the climate was cooler and moist and favored the growth of coniferous forest vegetation. As the climate warmed, deciduous forest invaded. This type of forest vegetation persisted until about 9,000 years ago. Since that time, the climate has been characterized by further warming and greater dryness. Under these climatic conditions the dominant vegetation has been mixed prairie grasses and deciduous forest.

The general climate has had an important overall influence on the characteristics of the soils, but it has not caused major differences among them. The influence of general climate in a region is modified by local conditions. For example, the soils on south-facing slopes formed under a microclimate that is warmer and drier than that of soils in nearby areas. Also, the low lying, poorly drained soils on flood plains formed under a microclimate that is wetter and colder than that of most of the surrounding soils. Local conditions account for some of the differences among soils in the county.

Changes in temperature activate the weathering of parent material by water and air. As the parent material weathers, changes caused by physical and chemical actions take place. Rainfall affects the amount of leaching in the soil and the kinds of plants on the soil. Temperature and other climatic factors indirectly affect soil formation through their effect on plant and animal life on and in the soil.

Living Organisms

Plant and animal life has an important effect on the formation of soils. Plant life is especially significant because it helps to initiate soil formation. Different kinds of plant life have a marked influence on the differences among soils.

The soils of Lucas County appear to have been influenced in recent times by two main kinds of plant life—prairie grasses and deciduous trees. The main prairie grasses were big bluestem, little bluestem, and indiangrass. The trees were mainly

oak, hickory, ash, elm, maple, and other deciduous trees.

The native grasses, which have many roots and tops, have decayed in or on the soil and thus have added large amounts of organic matter to the surface layer of some soils. As a result, these soils have a thicker dark surface layer than soils that formed under trees.

The soils that formed under mixed grasses and trees have properties of soils that formed only under grasses and of soils that formed only under trees.

Grundy, Haig, and Shelby soils are typical of soils that formed under prairie grasses. Weller and Lindley soils are typical of soils that formed under trees (Prill and Riecken, 1958). Gara and Pershing soils are typical of soils that formed under mixed grasses and trees. They have properties intermediate between those of soils that formed only under grasses and those that formed only under trees.

Grundy, Pershing, and Weller soils are members of a biosequence, which is a group of soils that formed in the same parent material and under a similar climate but have supported different kinds of native vegetation. Grundy soils formed under prairie grasses, Pershing soils formed under mixed grasses and trees, and Weller soils formed under trees. The main morphological differences among the three soils are the result of the different kinds of native vegetation.

The activities of burrowing animals and insects tend to loosen and aerate the upper few feet of soil.

Relief

Relief has an important influence on the formation of soils. It indirectly affects soil formation through its influence on drainage. In Lucas County, relief ranges from level to very steep. In many areas on bottom land, the nearly level soils are occasionally flooded and have a permanently or periodically high water table. In depressions, water soaks into the nearly level soils that are subject to flooding. Much of the rainfall runs off the steep soils on uplands.

Level soils are on the broad upland flats and on the stream bottoms. The steepest soils in the county are generally on the southern and western sides of the major streams and their tributaries. The intricate pattern of upland drainageways indicates that the landscape in most of the county has been modified by geologic processes.

Haig soils, which formed in areas where the water table is high, have a dominantly grayish subsoil. Grundy and Pershing soils formed in areas where the water table fluctuated and was periodically high. Gara, Lindley, and Shelby soils and other soils that formed in areas where the water table was below the subsoil have a yellowish brown subsoil. Haig soils formed under prairie grasses and have a high water table. They contain more organic matter in the surface layer than well drained soils that formed under prairie grasses. Clay accumulates in the subsoil of Edina soils and other soils in slight depressions or in nearly level areas. A large amount of water enters the soils and carries the clay particles downward. Edina soils are commonly considered "claypan" soils because they have a very slowly permeable subsoil, in which a great amount of clay accumulates.

Pershing and Weller soils were studied to determine the effects of relief on the formation of soils. From the stable slopes to the unstable slopes where these soils occur, tests showed an increase in content of clay in the A horizon and a decrease in thickness of the A horizon. Soil formation is more pronounced on the more stable slopes.

In Gara, Lindley, Shelby, and similar soils that have a wide range in slope and are on many different kinds of slopes, the depth to carbonates is shallowest where the slopes are steepest, are convex, or are most unstable.

Parent Material

The accumulation of parent material is the first step in the formation of a soil. All of the soils in Lucas County formed in material that was transported from the site of the parent rock and redeposited at a new location through the action of glacial ice, water, wind, and gravity. The principal parent materials in Lucas County are glacial till, loess, and alluvium. The various geologic depositions and subsequent erosion by streams have resulted in the formation of moderately broad, nearly level and gently sloping ridgetops. The soils that formed in loess are on these ridgetops. The moderately sloping to very steep soils on side slopes formed in loess and glacial till. The soils on flood plains along streams formed in alluvium (fig. 6).

Glacial till is unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glacial till is the most extensive parent material in the county. It covers about 46 percent of the surface area. It is exposed in all parts of the county, and on steep slopes it forms a major part of the landscape. The unweathered till is firm, calcareous clay loam. It contains pebbles, boulders, and sand as well as silt and clay. The till is a heterogeneous mixture and

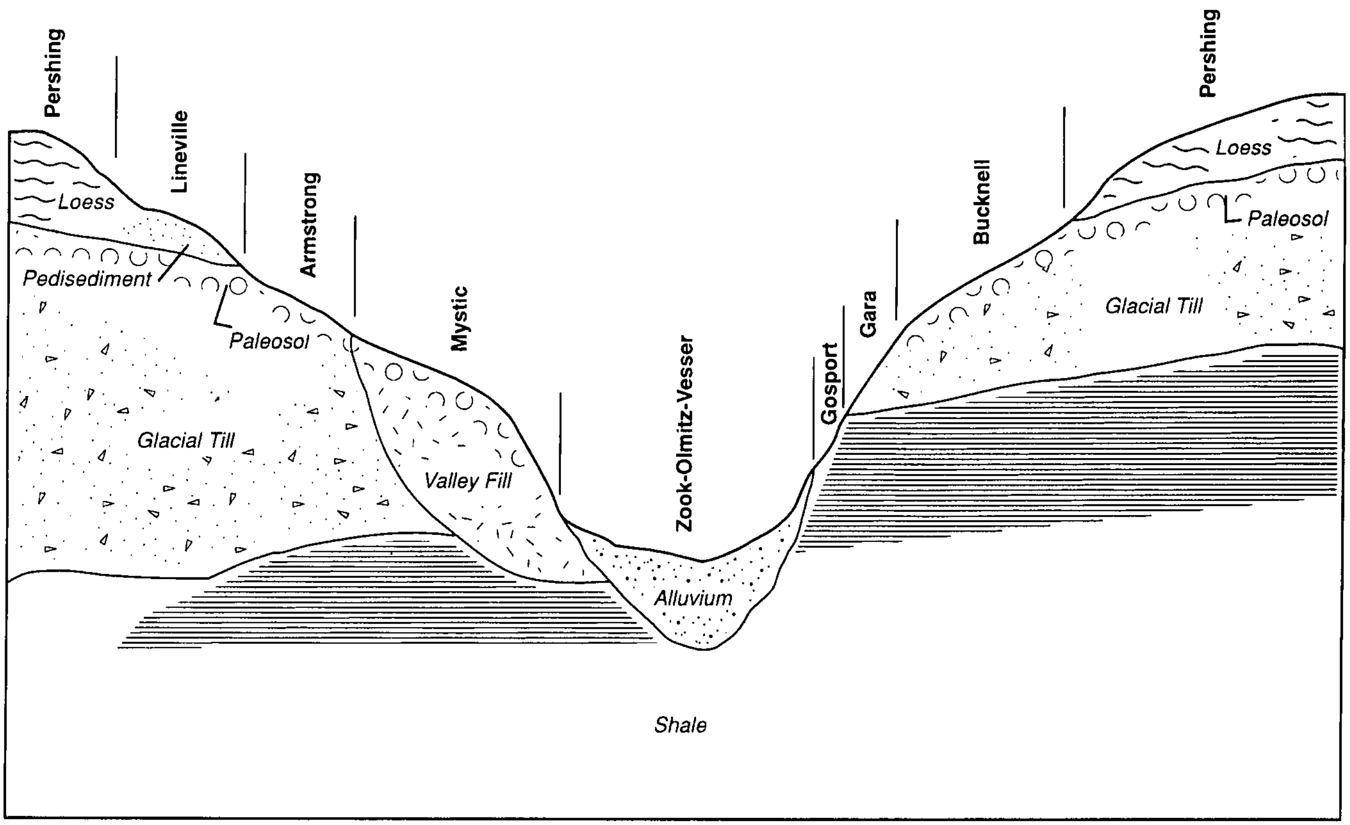

Figure 6.—Relationship of the major soils in Lucas County to parent material and to position on the landscape.

shows little evidence of sorting or stratification. The mineral composition of its components is also heterogeneous and is similar to that of particles in unweathered loess. The thickness of the glacial till ranges to more than 300 feet in places.

At least two major glaciations during the Pleistocene Epoch affected Lucas County. The Nebraskan Glaciation occurred about 750,000 years ago (Kay and Graham, 1943; Simonson, 1959). It was followed by the combined Yarmouth and Sangamon interglacial periods. As the glaciers retreated, they left behind a vast deposit of glacial till.

Nebraskan till is in a few places in the county. Kansan till is exposed on the steeper slopes in all parts of the county. This till forms an extensive part of the landscape.

The Aftonian paleosol formed on the Nebraskan till plain during the Aftonian interglacial period before the Kansas Glaciation. This paleosol is strongly weathered, gray clay that is very slowly permeable. It ranges from a few feet to several feet in thickness.

Soils formed on the Kansas till plain during the combined Yarmouth and Sangamon interglacial periods before the loess was deposited (Ruhe, 1968). In nearly level areas the soils were strongly weathered and have a thick, gray, plastic, clayey subsoil called "gumbotil." These soils are also called paleosols, or "ancient soils" (Ruhe, 1956b; Ruhe and Daniels, 1958). The Yarmouth-Sangamon paleosol (gumbotil) is several feet thick and is very slowly permeable. Clarinda and Rinda soils formed in this paleosol. They are extensive throughout Lucas County. Bucknell and Lamoni soils formed in the truncated Yarmouth-Sangamon paleosol. The clayey layer in these soils is not as thick as that in the Clarinda soils. Lamoni soils are extensive throughout Lucas County.

Late in the Sangamon interglacial period, geologic erosion cut through the Yarmouth-Sangamon paleosol and into the Kansan till. At the depth to which this erosion has cut, a stone line or subjacent till generally is overlain by pedisediment (Ruhe, 1956a; Ruhe, 1956b; Ruhe, 1959). A paleosol formed in this material. Geologic erosion removed the loess from any slopes and left the paleosol exposed on the surface. The late Sangamon paleosol generally is

reddish and is thinner than the Yarmouth-Sangamon paleosol. Adair, Armstrong, and Keswick soils formed in the late Sangamon paleosol.

Caleb and Mystic soils formed in pre-Sangamon sediments of valley fills. These sediments are of glacial origin and vary in texture (Ruhe, 1956b). They are on low-stepped interfluves above the present valley floor. They are on a landscape that is partly valley fill, but their surface merges with the present erosional uplands. The Caleb and Mystic soils are above the flood plain, but they are lower than the Gara, Lindley, and Shelby soils, which formed in Kansan till on dissected slopes of late Wisconsinan age. Gara, Lindley, and Shelby soils are extensive in Lucas County.

Loess, a silty material deposited by the wind, covers about 27 percent of the county. It was deposited during the Wisconsinan glacial period between 29,000 to 14,000 years ago (Hutton, 1947). It consists mostly of silt and some clay. It also contains small amounts (generally less than 5 percent) of fine sand and very fine sand. The major source of loess in Lucas County was probably the flood plains along the Missouri River and its tributaries in the western part of Iowa. The thickness of the loess and the content of clay in the loess are related to the distance from the source of the loess.

The thickness of the loess in Lucas County ranges from 8 to 12 feet on the stable upland divides. It is thinner on side slopes and in narrow, low interfluves. The loess is slightly thicker in the northwestern part of the county. It also occurs in the rest of the county, in areas where Arispe, Edina, Grundy, Haig, Pershing, and Weller soils formed. Lineville soils formed in 10 to 20 inches of loess over glacial sediments underlain by a late Sangamon paleosol weathered from glacial till.

Alluvium is sediment deposited by water along major and minor streams and drainageways. It is also on low stream terraces. It covers about 18 percent of the county. The texture of alluvium varies widely because of the source of the material and the manner in which it was deposited. Loess and glacial till are the main sources of alluvium in Lucas County.

Alluvial sediment is the parent material of soils on flood plains and terraces and in drainageways. As the streams overflow their channels, they deposit alluvium. The coarser or larger particles are deposited closer to the stream channel or in and along the main path of the floodwater. The finer particles are deposited in areas farther away from the stream channel, where the floodwater moves slowly or is still. Ackmore, Lawson, Nodaway, and Zook soils formed in silty alluvium. These soils are mainly on the flood plains along the Chariton River, Whitebreast Creek, and Otter Creek. Humeston and Vesser soils are on low stream terraces. They are less subject to overflow than other soils that formed in alluvium and thus show more profile development.

Colluvium is sediment deposited on or at the base of steep slopes by mass wasting and local, unconcentrated runoff. It retains many characteristics of soils on the slopes from which it is eroded. Olmitz soils formed in colluvium on foot slopes of till-derived soils.

Bedrock is the oldest parent material in the county. It is made up of a series of beds deposited during the Des Moines sedimentary cycle in the Pennsylvania period. These beds consist of limestone, shale of different colors and textures, conglomerate, and a few organic layers, such as coal. The thickness of these layers, or beds, varies widely. In Lucas County, coal veins are generally 50 to 100 feet below the surface. However, some are exposed on the surface.

Observations of roadbanks and cuts in the survey area showed 4 to 6 layers of shale and limestone exposed on the present land surface. The layer of lime rock commonly exposed is about 3 to 5 feet thick and has gray or brown shale above and below. Fragments of the lime rock layer are commonly on the surface of the side slope below outcroppings. These materials outcrop mainly on slopes along the lower part of tributaries of the Chariton River and Whitebreast Creek, north and west of Chariton, and along the lower part of Shoal and Cedar Creeks and their tributaries in the northeastern part of the county.

Gosport soils formed in brownish and grayish shales.

Time

The length of time that the soil material is acted upon by soil-forming processes affects the kind of soil that forms. The older soils have strongly expressed genetic horizons. Some soils on flood plains show little or no evidence of soil formation because they have not been in place long enough for the development of distinct horizons. Nodaway soils are examples.

An older soil generally has a higher content of clay in the subsoil than a younger soil forming in a similar parent material. As a soil forms, clay is moved from the surface layer to the subsoil. This transfer increases the content of clay in the subsoil. It is more evident in nearly level soils than in the more sloping soils.

In the steeper areas the soil material is generally removed before enough time has passed for the

development of a thick profile that has distinct horizons. Even if the soil material has been in place a long time, the soil still exhibits little development because much of the water runs off the slopes rather than through the soil material. Gara, Lindley, and Shelby soils formed on recently dissected slopes of late Wisconsinan age (Ruhe, 1959; Ruhe, 1956b).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. The table "Classification of the Soils" in Parts I and II of this publication shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquoll*, the suborder of the Mollisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, thickness of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, montmorillonitic, mesic Typic Haplaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Classification of the Soils

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics that are outside the range of the series)

Soil name	Family or higher taxonomic class
Ackmore	Aeric Fluvaquents, fine-silty, mixed, nonacid, mesic
*Adair	Aquic Argiudolls, fine, montmorillonitic, mesic
Arispe	Aquic Argiudolls, fine, montmorillonitic, mesic
Armstrong	Aquollic Hapludalfs, fine, montmorillonitic, mesic
Bucknell	Udollic Ochraqualfs, fine, montmorillonitic, mesic, sloping
Caleb	Mollic Hapludalfs, fine-loamy, mixed, mesic
Chequest	Typic Haplaquolls, fine, montmorillonitic, mesic
Clarinda	Typic Argiaquolls, fine, montmorillonitic, mesic, sloping
Edina	Typic Argialbolls, fine, montmorillonitic, mesic
Gara	Mollic Hapludalfs, fine-loamy, mixed, mesic
Gosport	Typic Dystrochrepts, fine, illitic, mesic
Grundy	Aquertic Argiudolls, fine, montmorillonitic, mesic
Haig	Typic Argiaquolls, fine, montmorillonitic, mesic
Humeston	Argiaquic Argialbolls, fine, montmorillonitic, mesic
Keswick	Aquic Hapludalfs, fine, montmorillonitic, mesic
Lamoni	Aquic Argiudolls, fine, montmorillonitic, mesic
Lawson	Cumulic Hapludolls, fine-silty, mixed, mesic
Lindley	Typic Hapludalfs, fine-loamy, mixed, mesic
Lineville	Aquollic Hapludalfs, fine-loamy, mixed, mesic
Mystic	Aquollic Hapludalfs, fine, montmorillonitic, mesic
Nodaway	Mollic Udifluvents, fine-silty, mixed, nonacid, mesic
Olmitz	Cumulic Hapludolls, fine-loamy, mixed, mesic
Pershing	Aquollic Hapludalfs, fine, montmorillonitic, mesic
Rinda	Mollic Ochraqualfs, fine, montmorillonitic, mesic, sloping
Shelby	Typic Argiudolls, fine-loamy, mixed, mesic
Tuskeego	Mollic Ochraqualfs, fine, montmorillonitic, mesic
Vesser	Argiaquic Argialbolls, fine-silty, mixed, mesic
Wabash	Vertic Haplaquolls, fine, montmorillonitic, mesic
Weller	Aquic Hapludalfs, fine, montmorillonitic, mesic
Zook	Cumulic Haplaquolls, fine, montmorillonitic, mesic

Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
13B	Zook-Olmitz-Vesser complex, 0 to 5 percent slopes	21,800	7.8
23C	Arispe silty clay loam, 5 to 9 percent slopes	3,975	1.4
23C2	Arispe silty clay loam, 5 to 9 percent slopes, moderately eroded	21,925	7.9
24D	Shelby clay loam, 9 to 14 percent slopes	210	*
24D2	Shelby clay loam, 9 to 14 percent slopes, moderately eroded	3,075	1.1
24E2	Shelby clay loam, 14 to 18 percent slopes, moderately eroded	4,340	1.6
24E3	Shelby clay loam, 14 to 18 percent slopes, severely eroded	285	0.1
24F2	Shelby clay loam, 18 to 25 percent slopes, moderately eroded	915	0.3
51	Vesser silt loam, 0 to 2 percent slopes	930	0.3
51+	Vesser silt loam, 0 to 2 percent slopes, overwash	355	0.1
51B	Vesser silt loam, 2 to 5 percent slopes	935	0.3
51B+	Vesser silt loam, 2 to 5 percent slopes, overwash	445	0.2
54	Zook silty clay loam, 0 to 2 percent slopes	2,595	0.9
54+	Zook silt loam, 0 to 2 percent slopes, overwash	1,320	0.5
54B	Zook silty clay loam, 2 to 5 percent slopes	790	0.3
65E	Lindley loam, 14 to 18 percent slopes	205	*
65E2	Lindley loam, 14 to 18 percent slopes, moderately eroded	425	0.2
65F	Lindley loam, 18 to 25 percent slopes	2,715	1.0
65F2	Lindley loam, 18 to 25 percent slopes, moderately eroded	4,645	1.7
65G	Lindley loam, 25 to 40 percent slopes	2,390	0.9
65G2	Lindley loam, 25 to 40 percent slopes, moderately eroded	3,345	1.2
93D2	Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded	1,470	0.5
94D2	Mystic-Caleb complex, 9 to 14 percent slopes, moderately eroded	2,145	0.8
94E2	Mystic-Caleb complex, 14 to 18 percent slopes, moderately eroded	1,035	0.4
131B	Pershing silt loam, 2 to 5 percent slopes	1,925	0.7
131C	Pershing silt loam, 5 to 9 percent slopes	6,935	2.5
131C2	Pershing silty clay loam, 5 to 9 percent slopes, moderately eroded	11,200	4.0
131D2	Pershing silty clay loam, 9 to 14 percent slopes, moderately eroded	520	0.2
132B	Weller silt loam, 2 to 5 percent slopes	230	*
132C	Weller silt loam, 5 to 9 percent slopes	1,245	0.4
132C2	Weller silty clay loam, 5 to 9 percent slopes, moderately eroded	1,585	0.6
132D2	Weller silty clay loam, 9 to 14 percent slopes, moderately eroded	305	0.1
172	Wabash silty clay, 0 to 2 percent slopes	455	0.2
179D2	Gara clay loam, 9 to 14 percent slopes, moderately eroded	1,680	0.6
179E	Gara loam, 14 to 18 percent slopes	870	0.3
179E2	Gara clay loam, 14 to 18 percent slopes, moderately eroded	14,985	5.4
179E3	Gara clay loam, 14 to 18 percent slopes, severely eroded	205	*
179F	Gara loam, 18 to 25 percent slopes	2,355	0.8
179F2	Gara clay loam, 18 to 25 percent slopes, moderately eroded	15,400	5.5
179G2	Gara clay loam, 25 to 40 percent slopes, moderately eroded	710	0.3
192C2	Adair clay loam, 5 to 9 percent slopes, moderately eroded	3,125	1.1
192D2	Adair clay loam, 9 to 14 percent slopes, moderately eroded	1,730	0.6
211	Edina silt loam, depressional, 0 to 1 percent slopes	2,160	0.8
220	Nodaway silt loam, 0 to 2 percent slopes	6,440	2.3
222C	Clarinda silty clay loam, 5 to 9 percent slopes	695	0.2
222C2	Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded	7,660	2.8
222C3	Clarinda silty clay loam, 5 to 9 percent slopes, severely eroded	765	0.3
222D2	Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded	785	0.3
223C2	Rinda silty clay loam, 5 to 9 percent slopes, moderately eroded	460	0.2
223D2	Rinda silty clay loam, 9 to 14 percent slopes, moderately eroded	430	0.2
269	Humeston silty clay loam, 0 to 2 percent slopes	1,135	0.4
269+	Humeston silt loam, 0 to 2 percent slopes, overwash	355	0.1
273B	Olmitz loam, 2 to 5 percent slopes	700	0.3
273C	Olmitz loam, 5 to 9 percent slopes	565	0.2
313D2	Gosport silty clay loam, 9 to 14 percent slopes, moderately eroded	395	0.1
313E2	Gosport silty clay loam, 14 to 18 percent slopes, moderately eroded	935	0.3
313F	Gosport silt loam, 18 to 25 percent slopes	225	*
313F2	Gosport silty clay loam, 18 to 25 percent slopes, moderately eroded	1,225	0.4
362	Haig silt loam, 0 to 2 percent slopes	13,675	4.9
364B	Grundy silty clay loam, 2 to 5 percent slopes	20,435	7.3

See footnote at end of table.

Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
423C2	Bucknell silty clay loam, 5 to 9 percent slopes, moderately eroded	1,220	0.4
423D	Bucknell silty clay loam, 9 to 14 percent slopes	305	0.1
423D2	Bucknell silty clay loam, 9 to 14 percent slopes, moderately eroded	6,800	2.4
425D	Keswick loam, 9 to 14 percent slopes	2,180	0.8
425D2	Keswick clay loam, 9 to 14 percent slopes, moderately eroded	4,085	1.5
430	Ackmore silt loam, 0 to 2 percent slopes	1,195	0.4
451D2	Caleb loam, 9 to 14 percent slopes, moderately eroded	245	*
451E2	Caleb loam, 14 to 18 percent slopes, moderately eroded	420	0.2
452C	Lineville silt loam, 5 to 9 percent slopes	535	0.2
452C2	Lineville silt loam, 5 to 9 percent slopes, moderately eroded	250	*
453	Tuskeego silt loam, 0 to 2 percent slopes	310	0.1
470D2	Lamoni-Shelby complex, 9 to 14 percent slopes, moderately eroded	2,990	1.1
484	Lawson silt loam, 0 to 2 percent slopes	470	0.2
587	Chequest silty clay loam, 0 to 2 percent slopes	555	0.2
587+	Chequest silt loam, 0 to 2 percent slopes, overwash	280	0.1
592C2	Mystic clay loam, 5 to 9 percent slopes, moderately eroded	1,385	0.5
592D2	Mystic clay loam, 9 to 14 percent slopes, moderately eroded	2,165	0.8
711	Nodaway-Lawson complex, 0 to 2 percent slopes	3,125	1.1
792C	Armstrong loam, 5 to 9 percent slopes	400	0.1
792C2	Armstrong clay loam, 5 to 9 percent slopes, moderately eroded	2,630	0.9
792D	Armstrong loam, 9 to 14 percent slopes	1,575	0.6
792D2	Armstrong clay loam, 9 to 14 percent slopes, moderately eroded	18,500	6.6
792D3	Armstrong clay loam, 9 to 14 percent slopes, severely eroded	215	*
822C	Lamoni silty clay loam, 5 to 9 percent slopes	420	0.2
822C2	Lamoni silty clay loam, 5 to 9 percent slopes, moderately eroded	4,605	1.7
822D	Lamoni silty clay loam, 9 to 14 percent slopes	200	*
822D2	Lamoni silty clay loam, 9 to 14 percent slopes, moderately eroded	3,905	1.4
831B	Pershing silt loam, bench, 2 to 5 percent slopes	825	0.3
831C	Pershing silt loam, bench, 5 to 9 percent slopes	855	0.3
831C2	Pershing silty clay loam, bench, 5 to 9 percent slopes, moderately eroded	1,205	0.4
894D2	Bucknell-Gara complex, 9 to 14 percent slopes, moderately eroded	395	0.1
993D2	Gara-Armstrong complex, 9 to 14 percent slopes, moderately eroded	2,140	0.8
1711	Nodaway-Lawson complex, channeled, 0 to 2 percent slopes	3,260	1.2
5021	Orthents, hilly	100	*
5025	Strip mines, dumps	120	*
5040	Orthents, loamy	165	*
	Total	278,300	100.0

* Less than 0.1 percent.

Soil Series and Detailed Soil Map Units

In this section, arranged in alphabetical order, each soil series recognized in the survey area is described. Each description is followed by the detailed soil map units associated with the series.

Characteristics of the soil and the material in which it formed are identified for each soil series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (USDA, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA, 1975). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units on the detailed soil maps represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information about each map unit is given in Part II of this survey.

A map unit delineation on the detailed soil maps represents an area on the landscape and consists of one or more soils or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit descriptions. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit. The principal hazards and limitations to be considered in planning for specific uses are described in Part II of this survey.

Soils that have profiles that are almost alike make up a *soil series.* Except for differences in texture of the surface layer or of the underlying layers, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying layers. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that

affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Arispe silty clay loam, 5 to 9 percent slopes, is a phase of the Arispe series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are called soil complexes.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Zook-Olmitz-Vesser complex, 0 to 5 percent slopes, is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Strip mines, dumps, is an example.

The table "Acreage and Proportionate Extent of the Soils" in Parts I and II of this survey gives the acreage and proportionate extent of each map unit. Other tables (see Contents) give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

Ackmore Series

Drainage class: Somewhat poorly drained
Permeability: Moderate
Landform: Flood plains
Parent material: Silty alluvium
Native vegetation: Prairie grasses
Slope range: 0 to 2 percent

Typical Pedon

Ackmore silt loam, 0 to 2 percent slopes, in a cultivated field, 495 feet north and 330 feet west of the southeast corner of sec. 29, T. 72 N., R. 23 W.; U.S.G.S. Lucas, Iowa, topographic quadrangle; lat. 94 degrees, 34 minutes, and 21 seconds N. and long. 45 degrees, 42 minutes, and 10 seconds W.

Ap—0 to 8 inches; silt loam, 80 percent very dark grayish brown (10YR 3/2) and 20 percent dark grayish brown (10YR 4/2); cloddy parting to moderate fine granular structure; friable; common medium and many very fine and fine roots; slightly acid; clear smooth boundary.

C1—8 to 18 inches; stratified dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and very dark grayish brown (10YR 3/2) silt loam; few fine distinct yellowish brown (10YR 5/4) mottles; massive; friable; few medium and many very fine and fine roots; slightly acid; abrupt smooth boundary.

C2—18 to 28 inches; stratified very dark grayish brown (10YR 3/2) and grayish brown (10YR 5/2) silt loam, white (10YR 8/2) dry; massive; friable; few medium and many very fine and fine roots; moderately acid; abrupt smooth boundary.

2Ab1—28 to 36 inches; black (10YR 2/1) silty clay loam; moderate fine prismatic structure parting to moderate very fine and fine granular; friable; common very fine and fine roots; moderately acid; clear smooth boundary.

2Ab2—36 to 45 inches; black (N 2/0) silty clay loam; moderate very fine and fine subangular blocky structure parting to moderate fine granular; friable; few very fine and fine roots; slightly acid; gradual smooth boundary.

2Ab3—45 to 55 inches; black (N 2/0) silty clay; moderate fine prismatic structure parting to moderate very fine and fine subangular blocky; firm; few very fine and fine roots; few faint pressure faces on faces of peds and in pores; slightly acid; gradual smooth boundary.

2Ab4—55 to 62 inches; black (N 2/0 and 10YR 2/1) silty clay loam; moderate fine prismatic structure parting to moderate very fine and fine subangular blocky; firm; few very fine and fine roots; slightly acid.

Range in Characteristics

Thickness of the A and C horizons: 20 to 36 inches

A horizon:
Hue—10YR
Value—3 or 4
Chroma—1 or 2
Texture—silt loam

C horizon:
Hue—10YR
Value—3 to 5
Chroma—1 or 2
Texture—silt loam

2Ab horizon:
Hue—10YR, 2.5Y, or neutral
Value—2
Chroma—0 or 1
Texture—silty clay loam or silt loam

430—Ackmore silt loam, 0 to 2 percent slopes

Composition

Ackmore and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Silty alluvium
Frequency of flooding: Occasional
Depth to the water table: 1 to 3 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.2 inches (high)
Organic matter content of the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Poorly drained areas
- Nodaway and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Adair Series

Drainage class: Moderately well drained
Permeability: Slow
Landform: Uplands
Parent material: Red paleosol weathered from glacial till
Native vegetation: Prairie grasses
Slope range: 5 to 14 percent

Typical Pedon

Adair clay loam, 5 to 9 percent slopes, moderately eroded, 220 feet east and 1,620 feet north of the southwest corner of sec. 4, T. 71 N., R. 20 W.

Ap—0 to 6 inches; clay loam, 80 percent very dark grayish brown (10YR 3/2) and 20 percent brown or dark brown (10YR 4/3); dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; friable; common medium and many very fine and fine roots; few very dark gray (10YR 3/1) organic coatings; slightly acid; clear smooth boundary.

Bt1—6 to 10 inches; brown or dark brown (7.5YR 4/4) clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; moderate very fine and fine subangular blocky structure; firm; few medium and many very fine and fine roots; few very dark grayish brown (10YR 3/2) organic coatings in root channels, in pores, or both; few distinct brown or dark brown (10YR 4/3) and very dark gray (10YR 3/1) clay films (cutans) on faces of peds; few fine rounded iron-manganese concretions; moderately acid; 10 percent pebbles (mixed); clear smooth boundary.

2Bt2—10 to 16 inches; brown or dark brown (7.5YR 4/4) clay; many fine distinct strong brown (7.5YR 5/6) mottles; moderate very fine and fine subangular blocky structure; very firm; few medium and many very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few distinct brown or dark brown (7.5YR 4/2) and dark gray (10YR 4/1) clay films (cutans) on faces of peds; very few light gray (10YR 7/2) discontinuous coatings; common fine rounded iron-manganese concretions; moderately acid; 10 percent pebbles (mixed); clear smooth boundary.

2Bt3—16 to 25 inches; yellowish red (5YR 5/6) clay; common fine distinct reddish brown (5YR 4/4) and yellowish red (5YR 4/6) mottles; moderate fine and medium prismatic structure parting to moderate fine subangular blocky; very firm; few medium and many very fine and fine roots; few dark gray (10YR 4/1) organic coatings in root channels, pores, or both; few distinct brown or dark brown (7.5YR 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; moderately acid; 10 percent pebbles (mixed); gradual smooth boundary.

2Bt4—25 to 29 inches; strong brown (7.5YR 5/6) clay; common fine distinct yellowish red (5YR 4/6

and 5/8) mottles; moderate medium prismatic structure; very firm; few medium and common very fine and fine roots; few dark gray (10YR 4/1) organic coatings in root channels, pores, or both; few distinct dark grayish brown (10YR 4/2 and 4/4) clay films (cutans) on faces of peds; many fine and medium rounded iron-manganese concretions; neutral; 10 percent pebbles (mixed); gradual smooth boundary.

2Bt5—29 to 45 inches; strong brown (7.5YR 5/6) clay loam; common fine distinct yellowish red (5YR 4/6 and 5/8) and grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few medium and common very fine and fine roots; few distinct brown (10YR 5/3) or dark brown (10YR 4/3) clay films (cutans) on faces of peds; common fine and medium rounded iron-manganese concretions; neutral; 10 percent pebbles (mixed); gradual smooth boundary.

2BC—45 to 60 inches; clay loam, 50 percent yellowish brown (10YR 5/4) and 50 percent yellowish brown (10YR 5/6); many fine and medium distinct strong brown (7.5YR 4/6 and 5/8) and grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to weak fine and medium subangular blocky; firm; few very fine and fine roots; few faint brown (10YR 5/3) or dark brown (10YR 4/3) clay films (cutans) on faces of peds; common fine and medium rounded iron-manganese concretions; neutral.

Range in Characteristics

Thickness of the solum: 48 to more than 60 inches
Thickness of the mollic epipedon: 6 to 10 inches
Depth to carbonates: 48 to more than 60 inches

A horizon:
Hue—10YR or 7.5YR
Value—2 or 3
Chroma—1 or 2
Texture—clay loam or loam

Bt horizon:
Hue—10YR or 7.5YR
Value—4 or 5
Chroma—4 to 6
Texture—clay loam or loam

BC or C horizon:
Hue—2.5YR to 10YR
Value—3 to 5
Chroma—4 to 6
Texture—clay or clay loam

192C2—Adair clay loam, 5 to 9 percent slopes, moderately eroded

Composition

Adair and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Reddish paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.1 inches (high)
Organic matter content of the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Lamoni and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

192D2—Adair clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Adair and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Reddish paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.1 inches (high)
Organic matter content of the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Lamoni and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Arispe Series

Drainage class: Somewhat poorly drained
Permeability: Slow
Landform: Uplands
Parent material: Loess over a gray paleosol weathered from glacial till
Native vegetation: Prairie grasses
Slope range: 5 to 9 percent

Typical Pedon

Arispe silty clay loam, 5 to 9 percent slopes, 725 feet south and 2,310 feet east of the northwest corner of sec. 8, T. 71 N., R. 22 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1), black (10YR 2/1), and very dark grayish brown (10YR 3/2) silty clay loam; moderate very fine and fine granular structure; friable; common medium and many very fine and fine roots; slightly acid; clear smooth boundary.

Bt1—10 to 16 inches; dark grayish brown (10YR 4/2), brown or dark brown (10YR 4/3) exterior silty clay loam; common fine distinct dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/6) mottles; moderate very fine and fine subangular blocky structure; firm; common medium and many very fine and fine roots; common distinct dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/6) clay films on faces of peds and in pores; moderately acid; gradual smooth boundary.

Bt2—16 to 22 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silty clay; common fine prominent yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/6) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few medium roots, many very fine and fine roots, and few coarse roots; common distinct dark grayish brown (10YR 4/2) and dark gray (10YR 4/1) clay films on faces of peds and in pores; slightly acid; gradual smooth boundary.

Bt3—22 to 27 inches; grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2) silty clay loam; common fine prominent dark yellowish brown (10YR 4/6), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few medium and many very fine and fine roots; common distinct dark grayish brown (10YR 4/2 and 2.5Y 4/2) clay films on faces of peds and in pores; slightly acid; gradual smooth boundary.

Bt4—27 to 33 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent strong brown (7.5YR 4/6 and 5/8) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; firm; common very fine and fine roots; common distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds and in pores; neutral; gradual smooth boundary.

Bt5—33 to 43 inches; light brownish gray (2.5Y 6/2) silty clay loam; many fine and medium prominent strong brown (7.5YR 5/6 and 5/8) mottles; weak medium prismatic structure; friable; common

very fine and fine roots; common distinct grayish brown (2.5Y 5/2) clay films on faces of peds and in pores; neutral; gradual smooth boundary.

BC—43 to 56 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine prominent strong brown (7.5YR 4/6 and 5/8) mottles; massive; friable; few very fine and fine roots; very few faint grayish brown (2.5Y 5/2) clay films on faces of peds and in pores; neutral; abrupt smooth boundary.

2Bb—56 to 60 inches; dark gray (10YR 4/1) clay; common fine prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; very firm; neutral.

Range in Characteristics

Thickness of the solum: 36 to 60 inches
Thickness of the mollic epipedon: 6 to 14 inches
Depth to carbonates: More than 60 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silty clay loam

Bt horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 or 3
Texture—silty clay or silty clay loam

BC horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—silty clay loam

23C—Arispe silty clay loam, 5 to 9 percent slopes

Composition

Arispe and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, side slopes, and interfluves
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Loess over a gray paleosol weathered from glacial till
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 11.7 inches (high)
Organic matter content of the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

23C2—Arispe silty clay loam, 5 to 9 percent slopes, moderately eroded

Composition

Arispe and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, side slopes, and interfluves
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Loess over a gray paleosol weathered from glacial till
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 11.6 inches (high)
Organic matter content of the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Armstrong Series

Drainage class: Moderately well drained
Permeability: Slow
Landform: Uplands
Parent material: Reddish paleosol weathered from glacial till
Native vegetation: Mixed prairie grasses and deciduous trees
Slope range: 5 to 14 percent

Typical Pedon

Armstrong loam, 9 to 14 percent slopes, 330 feet north and 725 feet west of the southeast corner of sec. 21, T. 72 N., R. 22 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) loam; moderate very fine and fine granular structure; friable; common medium and many very fine and fine roots; neutral; clear smooth boundary.

E—7 to 11 inches; grayish brown (10YR 5/2) loam; common fine distinct yellowish brown (10YR 5/4) mottles; moderate thin platy structure; friable; common medium and many very fine and fine roots; common very dark grayish brown (10YR 3/2) organic coatings on faces of peds; neutral; clear smooth boundary.

BE—11 to 14 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak very fine and fine subangular blocky structure; friable; common medium and many very fine and fine roots; common dark grayish brown (10YR 4/2) and very dark gray (10YR 3/1) organic coatings on faces of peds; very strongly acid; 3 percent pebbles; clear smooth boundary.

Bt1—14 to 17 inches; dark yellowish brown (10YR 4/4) clay loam; common fine distinct yellowish red (5YR 4/6 and 5/8) mottles; moderate very fine and fine subangular blocky structure; firm; few medium and many very fine and fine roots; common very dark gray (10YR 3/1) organic coatings on faces of peds and common distinct dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; very strongly acid; 10 percent pebbles; clear smooth boundary.

2Bt2—17 to 25 inches; strong brown (7.5YR 5/6) clay; many medium prominent reddish brown (5YR 4/4), distinct yellowish red (5YR 4/6), and prominent yellowish red (5YR 5/8) and common fine dark reddish brown (2.5YR 3/4) and reddish brown (2.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; few medium and many very fine and fine roots; common very dark gray (10YR 3/1) organic coatings on faces of peds and common distinct dark brown or brown (7.5YR 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; very strongly acid; 30 percent pebbles; gradual smooth boundary.

2Bt3—25 to 32 inches; strong brown (7.5YR 5/8 and 5/6) clay; common fine distinct yellowish red (5YR 4/6) and red (2.5YR 4/6) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; few medium and many very fine and fine roots; common very dark gray (10YR 3/1) and dark gray (10YR 4/1) organic coatings and common distinct dark brown or brown (7.5YR 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; very strongly acid; 3 percent pebbles; gradual smooth boundary.

2Bt4—32 to 40 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct strong brown (7.5YR 4/6 and 5/8) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; common very fine and fine roots; common distinct dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; common fine and medium rounded iron-manganese concretions; slightly acid; 30 percent pebbles; gradual smooth boundary.

2Bt5—40 to 45 inches; yellowish brown (10YR 5/4 and 5/6) clay loam; common fine distinct light brownish gray (2.5Y 6/2), strong brown (7.5YR 4/6), and brown or dark brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; common very fine and fine roots;

common distinct grayish brown (10YR 5/2) clay films (cutans) on faces of peds; common fine and medium rounded iron-manganese concretions; neutral; 30 percent pebbles; gradual smooth boundary.

2Bt6—45 to 54 inches; yellowish brown (10YR 5/6) clay loam; common fine and medium prominent light brownish gray (2.5Y 6/2) and brown or dark brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few very fine and fine roots; common distinct grayish brown (10YR 5/2) clay films (cutans) on faces of peds; common fine and medium rounded iron-manganese concretions; neutral; 30 percent pebbles; gradual smooth boundary.

2Bt7—54 to 60 inches; light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) clay loam; common fine and medium distinct strong brown (7.5YR 4/6) and brown or dark brown (7.5YR 4/4) mottles; moderate medium prismatic structure; firm; common distinct grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; common fine and medium rounded iron-manganese concretions; neutral; 30 percent pebbles.

Range in Characteristics

Thickness of the solum: 42 to more than 60 inches
Thickness of the mollic epipedon: 6 to 10 inches
Depth to carbonates: 42 or more inches

A horizon:
Hue—10YR
Value—3
Chroma—1 or 2
Texture—loam or clay loam

E horizon:
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—loam or silt loam

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—2 to 8
Texture—clay loam

2Bt horizon:
Hue—10YR or 7.5YR
Value—4 to 6
Chroma—2 to 6
Texture—clay or clay loam

792C—Armstrong loam, 5 to 9 percent slopes

Composition

Armstrong and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Reddish paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.2 inches (high)
Organic matter content of the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

792C2—Armstrong clay loam, 5 to 9 percent slopes, moderately eroded

Composition

Armstrong and similar soils: 100 percent

Setting

Landform: Uplands

Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Reddish paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 8.8 inches (moderate)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

792D—Armstrong loam, 9 to 14 percent slopes

Composition

Armstrong and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Reddish paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.2 inches (high)
Organic matter content of the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

792D2—Armstrong clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Armstrong and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Reddish paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 8.8 inches (moderate)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

792D3—Armstrong clay loam, 9 to 14 percent slopes, severely eroded

Composition

Armstrong and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Reddish paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 8.8 inches (moderate)
Organic matter content of the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Bucknell Series

Drainage class: Somewhat poorly drained
Permeability: Slow
Landform: Uplands
Parent material: Gray paleosol weathered from glacial till
Native vegetation: Mixed prairie grasses and deciduous trees
Slope range: 5 to 14 percent

Typical Pedon

Bucknell silty clay loam, 5 to 9 percent slopes, moderately eroded, 2,410 feet south and 1,980 feet west of the northeast corner of sec. 29, T. 73 N., R. 21 W.

Ap—0 to 7 inches; 60 percent very dark grayish brown (10YR 3/2), very dark gray (10YR 3/1) exterior, 20 percent dark grayish brown (10YR 4/2), and 20 percent brown or dark brown (10YR 4/3) silty clay loam; 60 percent dark gray (10YR 4/1) dry, 40 percent gray (10YR 5/1) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; many fine roots; neutral; clear smooth boundary.

BE—7 to 11 inches; dark grayish brown (10YR 4/2) clay; common fine distinct dark yellowish brown (10YR 4/4) and few prominent brown or dark brown (7.5YR 4/4) mottles; moderate fine and medium subangular blocky structure; friable; common fine roots; few very dark grayish brown (10YR 3/2) organic coatings in root channels, pores, or both; few faint dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; neutral; clear smooth boundary.

Bt1—11 to 20 inches; brown (10YR 5/3) clay; common fine prominent brown or dark brown (7.5YR 4/4) and distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to weak fine subangular blocky; firm; common very fine and fine roots; few dark grayish brown (10YR 4/2) organic coatings in root channels, pores, or both; few distinct dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; common fine and medium irregular

iron-manganese concretions; neutral; gradual smooth boundary.

Bt2—20 to 29 inches; brown (10YR 5/3) clay; few fine prominent strong brown (7.5YR 4/6) and common distinct yellowish brown (10YR 5/6) mottles; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; very firm; common very fine and fine roots; few distinct grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; few fine rounded iron-manganese concretions; neutral; gradual smooth boundary.

Bt3—29 to 36 inches; clay loam, 60 percent grayish brown (10YR 5/2) and 40 percent yellowish brown (10YR 5/6); common fine distinct gray (10YR 5/1) and prominent strong brown (7.5YR 4/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very firm; few fine roots; few faint grayish brown (10YR 5/2) clay films (cutans) on faces of peds; few fine rounded iron-manganese concretions; neutral; gradual smooth boundary.

Bt4—36 to 49 inches; clay loam, 50 percent yellowish brown (10YR 5/6) and 50 percent gray (10YR 5/1); common fine prominent strong brown (7.5YR 4/6) mottles; moderate medium and coarse prismatic structure; very firm; few faint gray (10YR 5/1) and grayish brown (2.5Y 5/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral; gradual smooth boundary.

BC—49 to 60 inches; yellowish brown (10YR 5/6) clay loam; many medium prominent light gray or gray (5Y 6/1) mottles; moderate medium and coarse prismatic structure; very firm; few fine rounded iron-manganese concretions; neutral.

Range in Characteristics

Thickness of the solum: 48 to 60 inches
Depth to carbonates: More than 60 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silty clay loam

E horizon (if it occurs):
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—silt loam

Bt horizon:
Hue—10YR to 2.5Y
Value—4 to 6
Chroma—2 to 6
Texture—clay or clay loam

BC or C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—1 to 6
Texture—clay loam

423C2—Bucknell silty clay loam, 5 to 9 percent slopes, moderately eroded

Composition

Bucknell and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Gray paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Rinda and similar soils
- Severely eroded areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

423D—Bucknell silty clay loam, 9 to 14 percent slopes

Composition

Bucknell and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Gray paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.6 inches (high)
Organic matter content of the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Rinda and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

423D2—Bucknell silty clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Bucknell and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Gray paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Rinda and similar soils
- Severely eroded areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

894D2—Bucknell-Gara complex, 9 to 14 percent slopes, moderately eroded

Composition

Bucknell and similar soils: About 65 percent
Gara and similar soils: About 35 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Bucknell

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

Gara

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Caleb Series

Drainage class: Moderately well drained
Permeability: Moderate
Landform: Stream terraces
Parent material: Old valley alluvium
Native vegetation: Mixed prairie grasses and deciduous trees
Slope range: 9 to 18 percent

Typical Pedon

Caleb loam, 9 to 14 percent slopes, moderately eroded, 130 feet north and 925 feet west of the southeast corner of sec. 21, T. 72 N., R. 23 W.

Ap—0 to 7 inches; loam, 70 percent very dark grayish brown (10YR 3/2) and 30 percent brown or dark brown (10YR 4/3); grayish brown (10YR 5/2) dry; weak very fine and fine subangular blocky structure parting to weak very fine and fine granular; friable; few medium and many very fine and fine roots; slightly acid; clear smooth boundary.

Bt1—7 to 12 inches; clay loam, 50 percent brown or dark brown (10YR 4/3) and 50 percent dark yellowish brown (10YR 4/4); few fine faint dark yellowish brown (10YR 4/6) mottles; moderate fine and medium subangular blocky structure parting to moderate very fine and fine subangular blocky; friable; few medium and many very fine and fine roots; few dark brown (10YR 3/3) organic coatings, few distinct dark yellowish brown (10YR 4/4) clay films (cutans) on faces of peds, and few very pale brown (10YR 7/3) coatings; few fine rounded iron-manganese concretions; slightly acid; clear smooth boundary.

Bt2—12 to 19 inches; clay loam, 50 percent dark yellowish brown (10YR 4/4) and 50 percent brown or dark brown (10YR 4/3); common fine distinct yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/6) mottles; moderate very fine and fine subangular blocky structure; friable; few medium and many very fine and fine roots; few distinct brown or dark brown (10YR 4/3) clay films (cutans) on faces of peds and few very pale brown (10YR 7/3) coatings; few fine rounded iron-manganese concretions; moderately acid; clear smooth boundary.

Bt3—19 to 26 inches; yellowish brown (10YR 5/4) clay loam; moderate fine prismatic structure parting to moderate fine and medium subangular blocky; friable; common very fine and fine roots; few distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds, few dark yellowish brown (10YR 4/4) clay films (cutans), and few very pale brown (10YR 7/3) coatings; common fine rounded iron-manganese concretions; strongly acid; gradual smooth boundary.

Bt4—26 to 35 inches; yellowish brown (10YR 5/4) clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; common very fine and fine roots; very few prominent dark brown (7.5YR 3/4) clay films (cutans) on faces of peds and few distinct brown (10YR 5/3) coatings; common fine rounded iron-manganese concretions; strongly acid; gradual smooth boundary.

BC—35 to 43 inches; brown (10YR 5/3) clay loam; common fine prominent strong brown (7.5YR 5/8 and 4/6) mottles; moderate medium prismatic structure parting to moderate medium and coarse subangular blocky; friable; few very fine and fine roots; few distinct dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds and few pale brown (10YR 6/3) coatings; common fine rounded iron-manganese concretions; strongly acid; gradual smooth boundary.

C—43 to 60 inches; brown (10YR 5/3), strong brown (7.5YR 5/8 and 4/6), and grayish brown (10YR 5/2) clay loam; massive; friable; very strongly acid.

Range in Characteristics

Thickness of the solum: 42 to 60 inches
Depth to carbonates: Greater than 60 inches

A horizon:
Hue—10YR
Value—3
Chroma—1 or 2
Texture—loam or clay loam

E horizon (if it occurs):
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—silt loam or loam

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—clay loam or loam

BC or C horizon:
Hue—10YR
Value—4 or 5
Chroma—2 to 8
Texture—clay loam to silty clay loam

451D2—Caleb loam, 9 to 14 percent slopes, moderately eroded

Composition

Caleb and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Stream terraces
Geomorphic component: Side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Old valley alluvium
Flooding: None
Depth to the water table: 3 to 5 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.3 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

• Soils that have a thinner surface layer than the Caleb soil
• Somewhat poorly drained soils
• Severely eroded areas

Major Uses of the Unit

• Cropland
• Hayland
• Pasture
• Forest land

For general and detailed information concerning these uses, see Part II of this publication:

• Agronomy section

• Forest Land section

451E2—Caleb loam, 14 to 18 percent slopes, moderately eroded

Composition

Caleb and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Stream terraces
Geomorphic component: Side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Old valley alluvium
Flooding: None
Depth to the water table: 3 to 5 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.3 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

• Soils that have a thinner surface layer than the Caleb soil
• Soils that have more clay than the Caleb soil
• Severely eroded areas

Major Uses of the Unit

• Hayland
• Pasture
• Forest land

For general and detailed information concerning these uses, see Part II of this publication:

• Agronomy section
• Forest Land section

Chequest Series

Drainage class: Poorly drained
Permeability: Moderately slow
Landform: Flood plains
Parent material: Silty alluvium
Native vegetation: Mixed prairie grasses and trees
Slope range: 0 to 2 percent

Typical Pedon

Chequest silty clay loam, 0 to 2 percent slopes, 455 feet south and 660 feet west of the northeast corner of sec. 18, T. 71 N., R. 22 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam; moderate very fine and fine granular structure; friable; common medium and many very fine and fine roots; moderately acid; clear smooth boundary.

A—7 to 12 inches; black (10YR 2/1) silty clay loam; moderate very fine and fine angular blocky structure parting to moderate fine granular; friable; common medium and many very fine and fine roots; moderately acid; clear smooth boundary.

Btg1—12 to 18 inches; dark gray (10YR 4/1) silty clay loam; common fine prominent strong brown (7.5YR 4/6) and dark brown (7.5YR 3/2) mottles; moderate very fine and fine subangular blocky structure; firm; common medium and many very fine and fine roots; many very dark gray (10YR 3/1) clay films on faces of peds and common pale brown (10YR 6/3 dry) coatings of silt and very fine sand; common fine rounded iron-manganese concretions; moderately acid; gradual smooth boundary.

Btg2—18 to 24 inches; dark gray (10YR 4/1) silty clay loam; common fine prominent strong brown (7.5YR 4/6) and few dark reddish brown (5YR 3/3) mottles; moderate fine subangular blocky structure; firm; common medium and many very fine and fine roots; many very dark gray (10YR 3/1) clay films on faces of peds and common light gray (10YR 7/2 dry) coatings of silt and very fine sand; common fine rounded iron-manganese concretions; moderately acid; gradual smooth boundary.

Btg3—24 to 31 inches; dark gray (10YR 4/1) silty clay loam; common fine prominent strong brown (7.5YR 4/6) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few medium and many very fine and fine roots; many very dark gray (10YR 3/1) clay films on faces of peds and

common gray or light gray (10YR 6/1 dry) coatings of silt and very fine sand; common fine rounded iron-manganese concretions; moderately acid; gradual smooth boundary.

Btg4—31 to 39 inches; very dark gray (10YR 3/1) and dark gray (10YR 4/1) silty clay loam; common fine distinct brown (7.5YR 4/2) or dark brown (7.5YR 3/2) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few medium and many very fine and fine roots; many black (10YR 2/1) clay films on faces of peds and common gray or light gray (10YR 6/1 dry) coatings of silt and very fine sand; common fine rounded iron-manganese concretions; moderately acid; gradual smooth boundary.

Btg5—39 to 46 inches; dark gray (10YR 4/1) and very dark gray (10YR 3/1) silty clay loam; common fine distinct brown (7.5YR 4/2) or dark brown (7.5YR 3/2) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; firm; few medium and many very fine and fine roots; common black (10YR 2/1) clay films on faces of peds and common gray or light gray (10YR 6/1 dry) coatings of silt and very fine sand; common fine rounded iron-manganese concretions; moderately acid; gradual smooth boundary.

Btg6—46 to 60 inches; gray (10YR 5/1) and dark gray (10YR 4/1) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; firm; common very fine and fine roots; common faint black (10YR 2/1) clay films on faces of peds; common fine rounded iron-manganese concretions; neutral.

Range in Characteristics

Thickness of the solum: 42 to 65 inches
Thickness of the mollic epipedon: 10 to 15 inches
Depth to carbonates: Greater than 60 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1
Texture—silty clay loam or silt loam

Btg horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—1 or 2
Texture—silty clay loam or silt loam

587—Chequest silty clay loam, 0 to 2 percent slopes

Composition

Chequest and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Silty alluvium
Frequency of flooding: Occasional
Water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.0 inches (high)
Organic matter content of the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Zook and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

587+—Chequest silt loam, 0 to 2 percent slopes, overwash

Composition

Chequest and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Silty alluvium
Frequency of flooding: Occasional
Water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches (high)
Organic matter content of the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a higher content of clay

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Clarinda Series

Drainage class: Poorly drained
Permeability: Very slow
Landform: Uplands
Parent material: Gray paleosol weathered from glacial till
Native vegetation: Prairie grasses
Slope range: 5 to 14 percent

Typical Pedon

Clarinda silty clay loam, 5 to 9 percent slopes, 2,245 feet south and 2,530 feet east of the northwest corner of sec. 13, T. 71 N., R. 20 W.

Ap—0 to 10 inches; silty clay loam, 50 percent very dark gray (10YR 3/1) and 50 percent black (10YR 2/1); dark gray (10YR 4/1) dry; moderate very fine and fine granular structure; friable; many very fine and fine roots; neutral; clear smooth boundary.

AB—10 to 14 inches; 70 percent very dark grayish brown (10YR 3/2), 30 percent very dark gray (10YR 3/1) exterior silty clay loam; 70 percent grayish brown (2.5Y 5/2) dry and 30 percent gray (10YR 5/1) exterior dry; many fine faint dark grayish brown (10YR 4/2) mottles; weak fine subangular blocky structure parting to moderate very fine and fine granular; firm; few medium and many very fine and fine roots; slightly acid; clear smooth boundary.

Btg1—14 to 19 inches; dark gray (10YR 4/1) silty clay; common fine distinct brown or dark brown (7.5YR 4/4) and strong brown (7.5YR 4/6) mottles; moderate fine and medium subangular blocky structure; very firm; few medium and many very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few distinct dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; slightly acid; gradual smooth boundary.

Btg2—19 to 24 inches; grayish brown (2.5Y 5/2) silty clay; common fine prominent brown or dark brown (7.5YR 4/4), strong brown (7.5YR 4/6), and yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; few medium and common very fine and fine roots; few very dark gray (10YR 3/1) organic coatings on faces of peds and in pores; common distinct dark grayish brown (2.5Y 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral; gradual smooth boundary.

Btg3—24 to 35 inches; gray (5Y 5/1) silty clay; common fine distinct dark yellowish brown (10YR 4/4 and 4/6) and yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very firm; few medium and common very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few distinct dark gray (10YR 4/1) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral; gradual smooth boundary.

Btg4—35 to 45 inches; gray (5Y 5/1) silty clay; many fine prominent dark yellowish brown (10YR 4/6)

and yellowish brown (10YR 5/8) and few strong brown (7.5YR 5/6) and brown or dark brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very firm; few very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few distinct gray (10YR 5/1) and dark gray (10YR 4/1) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral; gradual smooth boundary.

Btg5—45 to 60 inches; light gray or gray (5Y 6/1) silty clay; many fine distinct dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/8) and prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very firm; few very fine and fine roots; few distinct gray (5Y 5/1) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral.

Range in Characteristics

Thickness of the solum: Greater than 60 inches
Thickness of the mollic epipedon: 6 to 14 inches
Depth to carbonates: Greater than 60 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1
Texture—silty clay loam

Btg horizon:
Hue—10YR to 5Y
Value—4 or 5
Chroma—1 or 2
Texture—silty clay or clay

222C—Clarinda silty clay loam, 5 to 9 percent slopes

Composition

Clarinda and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Gray paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches (high)
Organic matter content of the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

222C2—Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded

Composition

Clarinda and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Gray paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.2 inches (high)
Organic matter content of the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

222C3—Clarinda silty clay loam, 5 to 9 percent slopes, severely eroded

Composition

Clarinda and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Gray paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.2 inches (high)
Organic matter content of the surface layer: About 2.2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

222D2—Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Clarinda and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Gray paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.2 inches (high)
Organic matter content of the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Edina Series

Drainage class: Poorly drained
Permeability: Very slow
Landform: Upland depressions

Parent material: Loess
Native vegetation: Prairie grasses
Slope range: 0 to 1 percent

Typical Pedon

Edina silt loam, depressional, 0 to 1 percent slopes, 1,780 feet north and 2,045 feet west of the southeast corner of sec. 14, T. 71 N., R. 22 W.

Ap—0 to 9 inches; silt loam, 50 percent very dark gray (10YR 3/1) and 50 percent very dark grayish brown (10YR 3/2); dark gray (10YR 5/1) dry; cloddy parting to moderate fine granular structure; friable; common medium and many very fine and fine roots; strongly acid; clear smooth boundary.

E—9 to 16 inches; silt loam, 60 percent dark gray (10YR 4/1) and 40 percent dark grayish brown (10YR 4/2); 60 percent light gray or gray (10YR 6/1) dry and 40 percent gray (10YR 5/1) dry; moderate medium platy structure; friable; common medium and many very fine and fine roots; few very dark grayish brown (10YR 3/2) organic coatings on faces of peds and few white (10YR 8/2) coatings; few fine rounded iron-manganese concretions; strongly acid; clear smooth boundary.

EB—16 to 19 inches; silty clay loam, 50 percent dark grayish brown (10YR 4/2) and 50 percent grayish brown (10YR 5/2); 50 percent grayish brown (10YR 5/2) dry and 50 percent light brownish gray (10YR 6/2) dry; common fine distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak thick platy structure parting to moderate very fine and fine subangular blocky; firm; common medium and many very fine and fine roots; few very dark gray (10YR 3/1) organic coatings, few faint dark gray (10YR 4/1) clay films (cutans) on faces of peds, and few light gray (10YR 7/2) coatings; common fine rounded iron-manganese concretions; moderately acid; clear smooth boundary.

Bt1—19 to 25 inches; very dark gray (10YR 3/1) silty clay; common fine prominent strong brown (7.5YR 4/6 and 5/8) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; common medium and many very fine and fine roots; few prominent black (10YR 2/1) organic coatings; common fine rounded iron-manganese concretions; slightly acid; gradual smooth boundary.

Bt2—25 to 32 inches; silty clay, 50 percent dark grayish brown (2.5Y 4/2) and 50 percent light olive brown (2.5Y 5/4); common fine prominent dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/8) and few strong brown (7.5YR 4/6) mottles; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; common medium, very fine, and fine roots; few prominent very dark gray (10YR 3/1) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; slightly acid; gradual smooth boundary.

Bt3—32 to 43 inches; silty clay, 50 percent grayish brown (2.5Y 5/2) and 50 percent light olive brown (2.5Y 5/4); common fine prominent dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/8) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; firm; common medium, very fine, and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few distinct dark grayish brown (2.5Y 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral; gradual smooth boundary.

BCg—43 to 55 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/8) and prominent strong brown (7.5YR 4/6 and 5/8) mottles; weak medium and coarse prismatic structure; firm; few medium and common very fine and fine roots; very few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; very few distinct dark grayish brown (2.5Y 4/2) clay films (cutans) on faces of peds; common fine irregular iron-manganese concretions; neutral; gradual smooth boundary.

Cg—55 to 60 inches; silty clay loam, 70 percent light brownish gray (2.5Y 6/2) and 30 percent strong brown (7.5YR 5/6); massive; friable; few fine and medium roots; very few dark gray (10YR 4/1) organic coatings in root channels, pores, or both; very few faint grayish brown (2.5Y 5/2) clay films (cutans) on faces of peds; many fine rounded iron-manganese concretions; neutral.

Range in Characteristics

Thickness of the solum: 40 to more than 60 inches
Thickness of the mollic epipedon: 10 to 18 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1
Texture—silt loam

E horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—1 or 2
Texture—silt loam

Bt horizon:
Hue—10YR or 2.5Y
Value—2 or 3
Chroma—1 or 2
Texture—silty clay or clay

Cg horizon:
Hue—7.5YR to 2.5Y
Value—4 to 6
Chroma—1 or 2
Texture—silty clay loam

211—Edina silt loam, depressional, 0 to 1 percent slopes

Composition

Edina and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Upland depressions
Geomorphic component: Divides
Hillslope position: Summits
Slope: 0 to 1 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Loess
Flooding: None
Water table: 0.5 foot above to 1.0 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.0 inches (high)
Organic matter content of the surface layer: About 4 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a thinner surface layer than the Edina soil

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Gara Series

Drainage class: Well drained
Permeability: Moderately slow
Landform: Uplands
Parent material: Glacial till
Native vegetation: Mixed prairie grasses and deciduous trees
Slope range: 9 to 40 percent

Typical Pedon

Gara loam, 18 to 25 percent slopes, 2,005 feet north and 1,850 feet east of the southwest corner of sec. 27, T. 72 N., R. 21 W.

Ap—0 to 7 inches; loam, very dark gray (10YR 3/1) and 20 percent dark yellowish brown (10YR 4/4); dark gray (10YR 4/1) dry; moderate very fine and fine granular structure; friable; common medium and many very fine and fine roots; moderately acid; clear smooth boundary.

Bt1—7 to 12 inches; dark yellowish brown (10YR 4/4) clay loam; moderate very fine and fine subangular blocky structure parting to moderate very fine and fine angular blocky; friable; common fine and many very fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few distinct brown or dark brown (10YR 4/3) clay films (cutans) on faces of peds and very few yellowish brown (10YR 5/6) oxide coatings; moderately acid; 2 percent pebbles (mixed); clear smooth boundary.

Bt2—12 to 16 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct brown or dark brown (7.5YR 4/4) mottles; moderate very fine and fine subangular blocky structure; firm; few medium and many very fine and fine roots; few distinct dark yellowish brown (10YR 4/4) clay films (cutans) on faces of peds; few fine rounded iron-manganese concretions; moderately acid; 5 percent pebbles (mixed); gradual smooth boundary.

Bt3—16 to 21 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct grayish brown (10YR 5/2) mottles; moderate medium prismatic

structure parting to moderate fine subangular blocky; firm; few medium and many very fine and fine roots; few distinct brown or dark brown (10YR 4/3) clay films (cutans) on faces of peds and few brown or dark brown (7.5YR 4/4) oxide coatings; common fine rounded iron-manganese concretions; moderately acid; 4 percent pebbles (mixed); gradual smooth boundary.

Bt4—21 to 26 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct grayish brown (2.5Y 5/2) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few medium and common very fine and fine roots; few distinct dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) clay films (cutans) on faces of peds and few brown or dark brown (7.5YR 4/4) oxide coatings; common fine rounded iron-manganese concretions; slightly acid; 4 percent pebbles (mixed); gradual smooth boundary.

Bt5—26 to 33 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct grayish brown (2.5Y 5/2) and brown or dark brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few medium and common very fine and fine roots; few distinct grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; slightly acid; 4 percent pebbles (mixed); gradual smooth boundary.

Bt6—33 to 47 inches; clay loam, 50 percent yellowish brown (10YR 5/6) and 50 percent grayish brown (2.5Y 5/2); common fine and medium distinct brown or dark brown (7.5YR 4/4) and strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few medium and common very fine and fine roots; few distinct brown or dark brown (10YR 4/3) and dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral; 3 percent pebbles (mixed); gradual smooth boundary.

BC—47 to 60 inches; clay loam, 50 percent yellowish brown (10YR 5/6) and 50 percent light gray or gray (10YR 6/1); common fine distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/8) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few very fine and fine roots; few faint dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 4/4) clay films (cutans) on faces of peds; common fine and medium irregular lime nodules; strongly effervescent; moderately alkaline; 3 percent pebbles (mixed).

Range in Characteristics

Thickness of the solum: 40 to 60 inches
Depth to carbonates: Greater than 30 inches

A horizon:
Hue—10YR
Value—3
Chroma—1 or 2
Texture—loam or clay loam

E horizon (if it occurs):
Hue—10YR
Value—3 or 4
Chroma—2
Texture—loam

Bt horizon:
Hue—10YR or 7.5YR
Value—4 or 5
Chroma—3 to 6
Texture—clay loam

179D2—Gara clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Gara and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this

map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Armstrong and similar soils
- Severely eroded areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

179E—Gara loam, 14 to 18 percent slopes

Composition

Gara and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches (high)
Organic matter content of the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Armstrong and similar soils
- Rinda and similar soils

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

179E2—Gara clay loam, 14 to 18 percent slopes, moderately eroded

Composition

Gara and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Armstrong and similar soils
- Severely eroded areas

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

179E3—Gara clay loam, 14 to 18 percent slopes, severely eroded

Composition

Gara and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Organic matter content of the surface layer: About 1.5 percent (moderately low)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Armstrong and similar soils
- Soils that have a thicker surface layer than the Gara soil

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

179F—Gara loam, 18 to 25 percent slopes

Composition

Gara and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 18 to 25 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches (high)
Organic matter content of the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

179F2—Gara clay loam, 18 to 25 percent slopes, moderately eroded

Composition

Gara and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 18 to 25 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

179G2—Gara clay loam, 25 to 40 percent slopes, moderately eroded

Composition

Gara and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 25 to 40 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

993D2—Gara-Armstrong complex, 9 to 14 percent slopes, moderately eroded

Composition

Gara and similar soils: About 60 percent
Armstrong and similar soils: About 40 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Gara

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

Armstrong

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 8.8 inches (moderate)

Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Gosport Series

Drainage class: Moderately well drained
Permeability: Very slow
Landform: Uplands
Parent material: Residuum derived from shale
Native vegetation: Trees
Slope range: 9 to 25 percent

Typical Pedon

Gosport silty clay loam, 9 to 14 percent slopes, moderately eroded, 2,360 feet west and 2,430 feet south of the northeast corner of sec. 32, T. 73 N., R. 21 W.

Ap—0 to 6 inches; silty clay loam, 80 percent brown or dark brown (10YR 4/3) and 20 percent yellowish brown (10YR 5/6); 80 percent light yellowish brown (2.5Y 6/4) dry and 20 percent brownish yellow (10YR 6/6) dry; weak fine subangular blocky structure parting to weak fine granular; friable; many fine and medium roots; few dark brown (10YR 3/3) organic coatings on faces of peds; neutral; 3 percent pebbles of shale-siltstone; abrupt smooth boundary.

Bw1—6 to 15 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine prominent strong brown (7.5YR 5/6) and reddish yellow (7.5YR 6/8) mottles; weak medium subangular blocky structure parting to moderate fine subangular blocky; friable; common very fine and fine roots; few distinct brown (10YR 5/3) coatings on faces of peds; common fine rounded iron-manganese concretions; strongly acid; gradual smooth boundary.

Bw2—15 to 21 inches; light brownish gray (2.5Y 6/2) silty clay; many fine prominent reddish yellow (7.5YR 6/8) mottles; weak medium subangular blocky structure parting to moderate thin platy; friable; few medium and common fine roots; few distinct gray (10YR 5/1) coatings in root channels, pores, or both; many fine irregular iron-manganese concretions; very strongly acid; gradual smooth boundary.

Bw3—21 to 36 inches; light brownish gray (2.5Y 6/2) silty clay; many fine prominent strong brown (7.5YR 5/8) mottles; weak medium prismatic structure; firm; common fine roots; few gray (10YR 5/1) coatings in root channels, pores, or both; common fine irregular iron-manganese concretions and few fine platelike ironstone nodules; extremely acid; clear smooth boundary.

2Cr—36 to 60 inches; black (N 2/0) silty clay loam shale; common fine distinct pale brown (10YR 6/3) and few prominent strong brown (7.5YR 5/6) mottles; massive parting to weak thin platy structure; friable; extremely acid.

Range in Characteristics

Thickness of the solum: 20 to 40 inches
Depth to shale: 30 to 40 inches

A horizon:
Hue—10YR
Value—3 or 4
Chroma—2 or 3
Texture—silty clay loam or silt loam

E horizon (if it occurs):
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—silt loam or silty clay loam

Bw horizon:
Hue—10YR to 5Y
Value—5 or 6
Chroma—2 to 4
Texture—silty clay loam or silty clay

2Cr horizon:
Hue—2.5Y, 5Y, or neutral
Value—2 to 5
Chroma—0 to 2
Texture—silty clay loam or silty clay

313D2—Gosport silty clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Gosport and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: 20 to 40 inches
Drainage class: Moderately well drained
Dominant parent material: Residuum derived from shale
Flooding: None
Depth to the water table: 1.5 to 3.0 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 4.8 inches (low)
Organic matter content of the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Areas of calcareous soils
- Severely eroded areas

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

313E2—Gosport silty clay loam, 14 to 18 percent slopes, moderately eroded

Composition

Gosport and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: 20 to 40 inches
Drainage class: Moderately well drained
Dominant parent material: Residuum derived from shale
Flooding: None
Depth to the water table: 1.5 to 3.0 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 4.8 inches (low)
Organic matter content of the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Areas of calcareous soils
- Severely eroded areas

Major Uses of the Unit

- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

313F—Gosport silt loam, 18 to 25 percent slopes

Composition

Gosport and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes

Hillslope position: Backslopes
Slope: 18 to 25 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: 20 to 40 inches
Drainage class: Moderately well drained
Dominant parent material: Residuum derived from shale
Flooding: None
Depth to the water table: 1.5 to 3.0 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 5.3 inches (low)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Areas of calcareous soils

Major Uses of the Unit

- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

313F2—Gosport silty clay loam, 18 to 25 percent slopes, moderately eroded

Composition

Gosport and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 18 to 25 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: 20 to 40 inches
Drainage class: Moderately well drained
Dominant parent material: Residuum derived from shale
Flooding: None
Depth to the water table: 1.5 to 3.0 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 4.8 inches (low)
Organic matter content of the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Areas of calcareous soils
- Severely eroded areas

Major Uses of the Unit

- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Grundy Series

Drainage class: Somewhat poorly drained
Permeability: Slow
Landform: Uplands
Parent material: Loess
Native vegetation: Prairie grasses
Slope range: 2 to 5 percent

Typical Pedon

Grundy silty clay loam, 2 to 5 percent slopes, 2,370 feet north and 1,020 feet east of the southwest corner of sec. 26, T. 72 N., R. 22 W.

Ap—0 to 8 inches; silty clay loam, 50 percent black (10YR 2/1) and 50 percent black (N 2/0); dark gray (10YR 4/1) dry; moderate fine granular structure; friable; common medium and many very fine and fine roots; neutral; clear smooth boundary.

A—8 to 12 inches; black (10YR 2/1) silty clay loam; 70 percent dark gray (10YR 4/1) dry and 30 percent grayish brown (10YR 5/2) dry; moderate very fine and fine granular structure; friable; few medium and many very fine and fine roots; very

few very dark grayish brown (10YR 3/2) coatings; neutral; clear smooth boundary.

BA—12 to 15 inches; brown or dark brown (10YR 4/3), very dark gray (10YR 3/1) exterior silty clay loam; moderate very fine and fine subangular blocky structure; firm; few medium and many very fine and fine roots; few black (10YR 2/1) organic coatings and few faint dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; few fine rounded iron-manganese concretions; neutral; clear smooth boundary.

Btg1—15 to 20 inches; dark grayish brown (10YR 4/2) silty clay; common fine distinct yellowish brown (10YR 5/6) and brown or dark brown (7.5YR 4/4) mottles; moderate fine prismatic structure parting to moderate very fine and fine subangular blocky; firm; few medium and many very fine and fine roots; few very dark gray (10YR 3/1) organic coatings and few faint very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; slightly acid; gradual smooth boundary.

Btg2—20 to 26 inches; dark grayish brown (2.5Y 4/2) silty clay; common fine distinct yellowish brown (10YR 5/6 and 5/4) and many olive brown (2.5Y 4/4) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; common very fine and fine roots; few prominent dark gray (10YR 4/1) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; slightly acid; gradual smooth boundary.

Btg3—26 to 35 inches; grayish brown (2.5Y 5/2) silty clay; common fine prominent strong brown (7.5YR 5/6) and distinct light olive brown (2.5Y 5/6) and olive brown (2.5Y 4/4) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; common very fine and fine roots; few dark gray (10YR 4/1) organic coatings in root channels, pores, or both; few distinct dark grayish brown (2.5Y 4/2) clay films (cutans) on faces of peds; common fine and medium rounded iron-manganese concretions; slightly acid; gradual smooth boundary.

Btg4—35 to 44 inches; olive gray (5Y 5/2) silty clay loam; many fine and medium prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few very fine and fine roots; few faint dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; many fine and medium rounded iron-manganese concretions; slightly acid; gradual smooth boundary.

Btg5—44 to 49 inches; olive gray (5Y 5/2) silty clay loam; many medium and coarse prominent strong brown (7.5YR 4/6) mottles; weak medium prismatic structure parting to weak medium and coarse subangular blocky; firm; few very fine and fine roots; few distinct olive gray (5Y 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; slightly acid; gradual smooth boundary.

Btg6—49 to 55 inches; olive gray (5Y 5/2) silty clay loam; many fine and medium prominent strong brown (7.5YR 4/6) mottles; weak medium and coarse prismatic structure; friable; few very fine and fine roots; very few faint olive gray (5Y 4/2) clay films (cutans) on faces of peds; common fine and medium rounded iron-manganese concretions; neutral; gradual smooth boundary.

C—55 to 60 inches; light olive gray (5Y 6/2) silt loam; many fine and medium prominent strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) mottles; massive; friable; few very fine and fine roots; very few dark reddish brown (5YR 3/2) coatings; many fine and medium rounded iron-manganese concretions; neutral.

Range in Characteristics

Thickness of the solum: 40 to 60 inches
Thickness of the mollic epipedon: 12 to 17 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1
Texture—silty clay loam or silt loam

Btg horizon:
Hue—10YR to 5Y
Value—3 or 4
Chroma—1 or 2
Texture—silty clay or silty clay loam

C horizon:
Hue—10YR to 5Y
Value—4 to 6
Chroma—1 or 2
Texture—silt loam or silty clay loam

364B—Grundy silty clay loam, 2 to 5 percent slopes

Composition

Grundy and similar soils: About 95 percent

Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Shoulders and summits
Slope: 2 to 5 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 1.5 to 3.0 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 10.0 inches (high)
Organic matter content of the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Haig and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Haig Series

Drainage class: Poorly drained
Permeability: Slow
Landform: Upland flats
Parent material: Loess
Native vegetation: Prairie grasses
Slope range: 0 to 2 percent

Typical Pedon

Haig silt loam, 0 to 2 percent slopes, 2,385 feet south and 495 feet west of the northeast corner of sec. 27, T. 72 N., R. 22 W.

Ap—0 to 7 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common medium and many very fine and fine roots; neutral; clear smooth boundary.

A1—7 to 15 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate very fine and fine granular structure; friable; few medium and many very fine and fine roots; very few gray (10YR 5/1) coatings; neutral; clear smooth boundary.

A2—15 to 21 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; common fine distinct yellowish brown (10YR 5/4) mottles; moderate very fine and fine subangular blocky structure parting to weak fine granular; firm; few medium and many very fine and fine roots; few gray (10YR 5/1) coatings; few fine rounded iron-manganese concretions; neutral; clear smooth boundary.

Btg1—21 to 26 inches; dark gray (10YR 4/1) silty clay; common fine distinct yellowish brown (10YR 5/4 and 5/6) and few prominent reddish brown (5YR 4/4) mottles; moderate very fine and fine subangular blocky structure; very firm; common very fine and fine roots; few black (10YR 2/1) organic coatings and few faint black (10YR 2/1) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral; gradual smooth boundary.

Btg2—26 to 34 inches; dark gray (10YR 4/1) silty clay; many fine distinct olive brown (2.5Y 4/4), common yellowish brown (10YR 5/6), and few prominent brown or dark brown (7.5YR 4/4) mottles; moderate fine subangular blocky structure; very firm; few very fine and fine roots; few black (10YR 2/1) organic coatings and few distinct very dark gray (10YR 3/1) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; slightly acid; gradual smooth boundary.

Btg3—34 to 42 inches; dark gray (5Y 4/1) silty clay; common fine prominent strong brown (7.5YR 5/6) and reddish brown (5YR 4/4) and distinct light olive brown (2.5Y 5/4) mottles; moderate medium prismatic structure parting to weak fine and medium subangular blocky; firm; few very fine and fine roots; few very dark gray (10YR 3/1) organic coatings and few distinct dark gray (10YR 4/1) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; slightly acid; gradual smooth boundary.

Btg4—42 to 51 inches; gray (5Y 5/1) silty clay loam;

common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure; firm; few very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few distinct dark gray (5Y 4/1) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral; gradual smooth boundary.

Btg5—51 to 60 inches; light olive gray (5Y 6/2) silty clay loam; common medium prominent strong brown (7.5YR 5/6) and fine distinct light olive brown (2.5Y 5/4) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few very fine and fine roots; very few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few faint olive gray (5Y 5/2) and olive gray (5Y 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral.

Range in Characteristics

Thickness of the solum: 52 to 60 inches
Thickness of the mollic epipedon: 20 to 27 inches
Depth to carbonates: Greater than 60 inches

A horizon:
Hue—10YR, 2.5Y, or neutral
Value—2 or 3
Chroma—0 or 1
Texture—silt loam or silty clay loam

Bt horizon:
Hue—10YR to 5Y
Value—3 to 5
Chroma—1 or 2
Texture—silty clay or silty clay loam

362—Haig silt loam, 0 to 2 percent slopes

Composition

Haig and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Upland flats
Geomorphic component: Divides
Hillslope position: Summits
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Loess
Flooding: None
Water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.3 inches (high)
Organic matter content of the surface layer: About 4 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Edina and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Humeston Series

Drainage class: Poorly drained
Permeability: Very slow
Landform: Flood plains
Parent material: Local alluvium
Native vegetation: Prairie grasses and scattered trees
Slope range: 0 to 2 percent

Typical Pedon

Humeston silty clay loam, 0 to 2 percent slopes, 2,475 feet south and 1,980 feet east of the northwest corner of sec. 30, T. 72 N., R. 21 W.

Ap—0 to 9 inches; black (10YR 2/1) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate very fine and fine subangular blocky structure parting to moderate fine granular; friable; many medium and fine roots; slightly acid; clear smooth boundary.

A—9 to 14 inches; black (10YR 2/1) silty clay loam; 80 percent dark gray (10YR 4/1) dry and 20 percent light gray (10YR 7/2) dry; weak fine and medium subangular blocky structure; friable; common medium and many very fine and fine roots; slightly acid; clear smooth boundary.

E1—14 to 19 inches; dark gray (10YR 4/1) silt loam;

30 percent light gray (10YR 7/2) dry and 70 percent light brownish gray (10YR 6/2) dry; moderate thick platy structure; friable; common medium and many very fine and fine roots; few very dark grayish brown (10YR 3/2) organic coatings in root channels, pores, or both; few light gray (10YR 7/2) coatings; common fine rounded iron-manganese concretions; strongly acid; clear smooth boundary.

E2—19 to 24 inches; silt loam, 50 percent dark gray (10YR 4/1) and 50 percent gray (10YR 5/1); 60 percent light gray (10YR 7/2) dry and 40 percent light brownish gray (10YR 6/2) dry; common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium platy structure; friable; few medium and many very fine and fine roots; few very dark grayish brown (10YR 3/2) organic coatings in root channels, pores, or both; few white (10YR 8/2) coatings; common fine rounded iron-manganese concretions; very strongly acid; clear smooth boundary.

EB—24 to 28 inches; silty clay loam, 50 percent gray (10YR 5/1) and 50 percent very dark gray (10YR 3/1); common fine distinct dark yellowish brown (10YR 4/4) mottles; weak thick platy structure parting to weak medium subangular blocky; friable; few medium and many very fine and fine roots; few distinct dark gray (10YR 4/1) clay films (cutans) on faces of peds; few light brownish gray (10YR 6/2) coatings; common fine rounded iron-manganese concretions; very strongly acid; clear smooth boundary.

Bt1—28 to 40 inches; black (10YR 2/1) silty clay; common fine distinct dark grayish brown (10YR 4/2) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few medium and common very fine and fine roots; black (N 2/0) organic coatings on faces of peds; few distinct black (N 2/0) and dark grayish brown (10YR 4/2) clay films (cutans); common fine rounded iron-manganese concretions; very strongly acid; gradual smooth boundary.

Bt2—40 to 54 inches; silty clay, 50 percent very dark gray (10YR 3/1) and 50 percent dark gray (5Y 4/1); common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few medium and common very fine and fine roots; few distinct black (10YR 2/1) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral; gradual smooth boundary.

Bt3—54 to 60 inches; silty clay, 50 percent black (10YR 2/1) and 50 percent dark gray (5Y 4/1); common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few medium and common very fine and fine roots; few faint black (N 2/0) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral.

Range in Characteristics

Thickness of the solum: Greater than 60 inches
Thickness of the mollic epipedon: 18 to 24 inches
Depth to carbonates: Greater than 60 inches

A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 or 1
Texture—silt loam or silty clay loam

E horizon:
Hue—10YR
Value—4 or 5
Chroma—1 or 2
Texture—silt loam

Bt horizon:
Hue—10YR to 5Y
Value—3 or 4
Chroma—1
Texture—silty clay

269—Humeston silty clay loam, 0 to 2 percent slopes

Composition

Humeston and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Local alluvium
Frequency of flooding: Occasional
Water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Organic matter content of the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Vesser and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

269+—Humeston silt loam, 0 to 2 percent slopes, overwash

Composition

Humeston and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Local alluvium
Frequency of flooding: Occasional
Water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Organic matter content of the surface layer: About 1.5 percent (moderately low)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Vesser and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Keswick Series

Drainage class: Moderately well drained
Permeability: Slow
Landform: Uplands
Parent material: Reddish paleosol weathered from glacial till
Native vegetation: Deciduous trees
Slope range: 9 to 14 percent

Typical Pedon

Keswick loam, 9 to 14 percent slopes, 3,050 feet east and 2,780 feet south of the northwest corner of sec. 22, T. 72 N., R. 23 W.

A—0 to 2 inches; very dark grayish brown (10YR 3/2) loam, light gray (10YR 7/2) dry; weak very fine and fine granular structure; friable; few medium and coarse and many very fine and fine roots; moderately acid; abrupt smooth boundary.

E—2 to 6 inches; brown (10YR 5/3) loam; 70 percent white (10YR 8/2) dry and 30 percent very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few medium and common very fine and fine roots; very strongly acid; abrupt smooth boundary.

Bt1—6 to 10 inches; brown (7.5YR 5/4) clay loam; moderate very fine and fine subangular blocky structure; firm; few medium and common very fine and fine roots; very strongly acid; 2 percent pebbles (mixed); clear smooth boundary.

2Bt2—10 to 13 inches; reddish brown (5YR 5/4) clay; common fine distinct yellowish red (5YR 4/6 and 5/8) and brown or dark brown (7.5YR 4/2) mottles; moderate very fine and fine subangular blocky structure parting to moderate very fine and fine angular blocky; firm; few medium and common very fine and fine roots; few distinct reddish brown (5YR 4/4) clay films (cutans) on faces of peds; very strongly acid; 5 percent pebbles (mixed); clear smooth boundary.

2Bt3—13 to 17 inches; reddish brown (5YR 4/4) clay; common fine distinct yellowish red (5YR 4/6 and

5/8) and dark reddish gray (5YR 4/2) mottles; moderate very fine and fine subangular blocky structure parting to moderate very fine and fine angular blocky; firm; few very coarse, few medium, and common very fine and fine roots; few distinct dark reddish brown (5YR 3/4) clay films (cutans) on faces of peds; very strongly acid; 5 percent pebbles (mixed); clear smooth boundary.

2Bt4—17 to 23 inches; brown or dark brown (7.5YR 4/4) clay; common fine distinct strong brown (7.5YR 4/6 and 5/8) and grayish brown (10YR 5/2) and prominent yellowish red (5YR 4/6) and reddish brown (5YR 4/4) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; few very fine and fine roots; few distinct brown or dark brown (7.5YR 4/2) and brown or dark brown (10YR 4/3) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; very strongly acid; 5 percent pebbles (mixed); gradual smooth boundary.

2Bt5—23 to 29 inches; clay loam, 50 percent strong brown (7.5YR 5/6) and 50 percent light brownish gray (10YR 6/2); many fine distinct reddish brown (5YR 4/4) and yellowish red (5YR 4/6 and 5/8) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; few very fine and fine roots; few distinct dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; strongly acid; 5 percent pebbles (mixed); gradual smooth boundary.

2Bt6—29 to 34 inches; clay loam, 50 percent light brownish gray (2.5Y 6/2) and 50 percent yellowish brown (10YR 5/6); common fine distinct strong brown (7.5YR 4/6 and 5/8) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine and fine roots; few distinct grayish brown (10YR 5/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; strongly acid; 2 percent pebbles (mixed); gradual smooth boundary.

2Bt7—34 to 42 inches; clay loam, 50 percent light brownish gray (2.5Y 6/2) and 50 percent yellowish brown (10YR 5/4); common fine distinct brown or dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6 and 5/8) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few distinct grayish brown (10YR 5/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; moderately acid; 2 percent pebbles (mixed); gradual smooth boundary.

2Bt8—42 to 52 inches; clay loam, 50 percent light brownish gray (2.5Y 6/2) and 50 percent yellowish brown (10YR 5/4); common fine distinct brown or dark brown (7.5YR 4/4) and strong brown (7.5YR 4/6 and 5/8) mottles; moderate medium prismatic structure; firm; few distinct grayish brown (10YR 5/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; slightly acid; 1 percent pebbles (mixed); gradual smooth boundary.

2BC—52 to 60 inches; clay loam, 50 percent light brownish gray (2.5Y 6/2) and 50 percent grayish brown (10YR 5/2); common fine distinct brown or dark brown (7.5YR 4/4) and strong brown (7.5YR 4/6 and 5/8) mottles; weak medium prismatic structure; firm; few distinct grayish brown (10YR 5/2) clay films (cutans) on faces of peds; few fine irregular carbonate nodules and common fine rounded iron-manganese concretions; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 45 to 60 inches
Depth to carbonates: 45 to 60 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam or clay loam

E horizon:
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—loam

Bt horizon:
Hue—5YR to 2.5Y
Value—4 or 5
Chroma—4 to 6
Texture—clay or clay loam

2BC horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—1 to 6
Texture—clay loam or loam

425D—Keswick loam, 9 to 14 percent slopes

Composition

Keswick and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Reddish paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 8.5 inches (moderate)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Poorly drained soil areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

425D2—Keswick clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Keswick and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Reddish paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 8.4 inches (moderate)
Organic matter content of the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Poorly drained soil areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Lamoni Series

Drainage class: Somewhat poorly drained
Permeability: Slow
Landform: Uplands
Parent material: Gray paleosol weathered from glacial till
Native vegetation: Prairie grasses
Slope range: 5 to 14 percent

Typical Pedon

Lamoni silty clay loam, 5 to 9 percent slopes, 660 feet south and 330 feet west of the northeast corner of sec. 14, T. 71 N., R. 20 W.

Ap—0 to 9 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate very fine and fine granular structure; friable; common medium and many very fine and fine roots; moderately acid; clear smooth boundary.

A—9 to 14 inches; black (10YR 2/1) clay loam; 50 percent dark gray (10YR 4/1) dry and 50 percent grayish brown (10YR 5/2) dry; weak very fine and fine subangular blocky structure parting to moderate fine granular; friable; few medium and many very fine and fine roots; moderately acid; gradual smooth boundary.

BA—14 to 18 inches; very dark gray (10YR 3/1) clay loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate very fine and fine subangular blocky structure; firm; few medium and many very fine and fine roots; few distinct dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; few fine rounded iron-manganese concretions; moderately acid; gradual smooth boundary.

Bt1—18 to 24 inches; brown or dark brown (10YR 4/3) clay; common fine distinct dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/8) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; many very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few distinct dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; moderately acid; gradual smooth boundary.

Bt2—24 to 33 inches; grayish brown (2.5Y 5/2) clay; common fine distinct dark yellowish brown (10YR 4/6) and strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; common very fine and fine roots; few dark gray (10YR 4/1) organic coatings in root channels, pores, or both; common distinct dark grayish brown (2.5Y 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; slightly acid; gradual smooth boundary.

Bt3—33 to 42 inches; clay, 50 percent light brownish gray (2.5Y 6/2) and 50 percent dark yellowish brown (10YR 4/6); common fine distinct strong brown (7.5YR 4/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine and fine roots; few distinct dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; slightly acid; gradual smooth boundary.

Bt4—42 to 53 inches; light brownish gray (2.5Y 6/2) clay loam; common fine distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 4/6) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; firm; few very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few distinct grayish brown (2.5Y 5/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral; gradual smooth boundary.

BC—53 to 60 inches; yellowish brown (10YR 5/6) clay loam; many fine distinct strong brown (7.5YR 4/6) and light brownish gray (2.5Y 6/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few very fine and fine roots; few faint dark yellowish brown (10YR 4/4) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral.

Range in Characteristics

Thickness of the solum: 48 to more than 60 inches
Thickness of the mollic epipedon: 10 to 16 inches
Depth to carbonates: 48 or more inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silty clay loam or clay loam

Bt horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—clay or clay loam

BC horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 6
Texture—clay loam or loam

470D2—Lamoni-Shelby complex, 9 to 14 percent slopes, moderately eroded

Composition

Lamoni and similar soils: About 70 percent
Shelby and similar soils: About 30 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Lamoni

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.5 inches (high)
Organic matter content of the surface layer: About 2.7 percent (moderate)

Shelby

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Organic matter content of the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

822C—Lamoni silty clay loam, 5 to 9 percent slopes

Composition

Lamoni and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Gray paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.7 inches (high)
Organic matter content of the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Clarinda and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

822C2—Lamoni silty clay loam, 5 to 9 percent slopes, moderately eroded

Composition

Lamoni and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Gray paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.5 inches (high)
Organic matter content of the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Clarinda and similar soils
- Severely eroded areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

822D—Lamoni silty clay loam, 9 to 14 percent slopes

Composition

Lamoni and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Gray paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.7 inches (high)
Organic matter content of the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Clarinda and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

822D2—Lamoni silty clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Lamoni and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes

Slope: 9 to 14 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Gray paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.5 inches (high)
Organic matter content of the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Clarinda and similar soils
- Severely eroded areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Lawson Series

Drainage class: Somewhat poorly drained
Permeability: Moderate
Landform: Flood plains
Parent material: Silty alluvium
Native vegetation: Prairie grasses and trees
Slope range: 0 to 2 percent

Typical Pedon

Lawson silt loam, 0 to 2 percent slopes, 1,815 feet south and 1,980 feet east of the northwest corner of sec. 30, T. 72 N., R. 23 W.

Ap—0 to 9 inches; black (10YR 2/1) silt loam; 80 percent gray (10YR 5/1) dry and 20 percent light brownish gray (10YR 6/2) dry; cloddy structure parting to moderate fine granular; friable; common medium and many very fine and fine roots; moderately acid; clear smooth boundary.

A1—9 to 14 inches; black (10YR 2/1) silt loam; 80 percent gray (10YR 5/1) dry and 20 percent dark gray (10YR 4/1) dry; moderate very fine and fine subangular blocky structure; friable; common medium and many very fine and fine roots; few light brownish gray (10YR 6/2) and light gray (10YR 7/2) coatings; moderately acid; gradual smooth boundary.

A2—14 to 22 inches; very dark gray (10YR 3/1) silt loam; 50 percent gray (10YR 5/1) dry and 50 percent light brownish gray (10YR 6/2) dry; moderate very fine and fine subangular blocky structure; friable; few medium and common very fine and fine roots; few light brownish gray (10YR 6/2) and light gray (10YR 7/2) coatings; slightly acid; gradual smooth boundary.

A3—22 to 34 inches; very dark grayish brown (10YR 3/2) silt loam; 60 percent light brownish gray (10YR 6/2) dry and 40 percent dark gray (10YR 4/1) dry; moderate very fine and fine subangular blocky structure; friable; common very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few light brownish gray (10YR 6/2) coatings; slightly acid; clear smooth boundary.

C1—34 to 43 inches; silt loam, 50 percent very dark grayish brown (10YR 3/2) and 50 percent dark grayish brown (10YR 4/2); common fine distinct dark yellowish brown (10YR 4/6 and 4/4) mottles; weak very fine and fine subangular blocky structure; friable; common very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few light brownish gray (10YR 6/2) and light gray (10YR 7/2) coatings; slightly acid; gradual smooth boundary.

C2—43 to 53 inches; silty clay loam, 50 percent very dark grayish brown (10YR 3/2) and 50 percent dark grayish brown (10YR 4/2); common fine distinct brown or dark brown (7.5YR 4/4) and strong brown (7.5YR 4/6) mottles; weak very fine and fine subangular blocky structure; friable; few very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; slightly acid; gradual smooth boundary.

C3—53 to 60 inches; silty clay loam, 34 percent very dark grayish brown (10YR 3/2), 33 percent very dark gray (10YR 3/1), and 33 percent dark grayish brown (10YR 4/2); moderate medium and coarse prismatic structure; friable; few very fine and fine roots; moderately acid.

Range in Characteristics

Thickness of the solum: 24 to 36 inches
Thickness of the mollic epipedon: 24 to 36 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam

C horizon:
Hue—10YR or 2.5Y
Value—3 to 6
Chroma—1 to 3
Texture—silty clay loam or silt loam

484—Lawson silt loam, 0 to 2 percent slopes

Composition

Lawson and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Silty alluvium
Frequency of flooding: Occasional
Depth to the water table: 1 to 3 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.0 inches (high)
Organic matter content of the surface layer: About 5.2 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Areas of poorly drained soils
- Nodaway and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Lindley Series

Drainage class: Well drained
Permeability: Moderately slow
Landform: Uplands
Parent material: Glacial till
Native vegetation: Trees
Slope range: 14 to 40 percent

Typical Pedon

Lindley loam, 18 to 25 percent slopes, 2,380 feet north and 2,355 feet west of the southeast corner of sec. 22, T. 72 N., R. 23 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; moderate very fine and fine granular structure; friable; common fine and medium roots; very strongly acid; clear smooth boundary.

E—4 to 7 inches; yellowish brown (10YR 5/4) loam; 70 percent light gray (10YR 7/2) dry and 30 percent very pale brown (10YR 7/3) dry; moderate medium platy structure parting to moderate thin platy; friable; few fine roots; few dark grayish brown (10YR 4/2) organic coatings in root channels, pores, or both; common fine rounded iron-manganese concretions; very strongly acid; 1 percent pebbles (mixed); clear smooth boundary.

Bt1—7 to 11 inches; yellowish brown (10YR 5/6) clay loam; moderate fine and medium subangular blocky structure; firm; few fine roots; few dark grayish brown (10YR 4/2) organic coatings in root channels, pores, or both; few distinct dark yellowish brown (10YR 4/4) clay films (cutans) on faces of peds and light gray (10YR 7/2) coatings; common fine rounded iron-manganese concretions; 10 percent pebbles (mixed); very strongly acid; clear smooth boundary.

Bt2—11 to 16 inches; yellowish brown (10YR 5/6) clay loam; moderate medium prismatic structure parting to strong fine angular blocky; very firm; few fine roots; few dark grayish brown (10YR 4/2) organic coatings in root channels, pores, or both; common distinct dark yellowish brown (10YR 4/4) clay films (cutans) on faces of peds;

common fine rounded iron-manganese concretions; very strongly acid; 10 percent pebbles (mixed); clear smooth boundary.

Bt3—16 to 24 inches; strong brown (7.5YR 5/6) clay loam; common fine and medium distinct grayish brown (2.5Y 5/2) and light brownish gray (2.5Y 6/2) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; few fine roots; few distinct dark grayish brown (10YR 4/2) organic coatings in root channels, pores, or both; few brown or dark brown (7.5YR 4/4) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; very strongly acid; 10 percent pebbles (mixed); clear smooth boundary.

Bt4—24 to 30 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct grayish brown (2.5Y 5/2) and brown or dark brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; few distinct very dark grayish brown (10YR 3/2) organic coatings in root channels, pores, or both; few prominent dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; slightly acid; 10 percent pebbles (mixed); clear smooth boundary.

Bt5—30 to 35 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few distinct very dark grayish brown (10YR 3/2) organic coatings in root channels, pores, or both; few brown or dark brown (10YR 4/3) clay films (cutans) on faces of peds; common fine and medium irregular soft masses of carbonate and common fine rounded iron-manganese concretions; slightly effervescent; moderately alkaline; 10 percent pebbles (mixed); gradual smooth boundary.

Bt6—35 to 41 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few distinct dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; common fine and medium irregular soft masses of carbonate and common fine rounded iron-manganese concretions; slightly effervescent; moderately alkaline; 10 percent pebbles (mixed); gradual smooth boundary.

BC—41 to 60 inches; clay loam, 50 percent yellowish brown (10YR 5/4) and 50 percent grayish brown (2.5Y 5/2); common fine distinct yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; very few distinct dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; common fine and medium irregular soft masses of carbonate and common fine rounded iron-manganese concretions; strongly effervescent; moderately alkaline; 10 percent pebbles (mixed).

Range in Characteristics

Thickness of the solum: 36 to 60 inches
Depth to carbonates: 36 to 60 inches

A horizon:
Hue—10YR
Value—3 or 4
Chroma—1 or 2
Texture—loam or clay loam

E horizon:
Hue—10YR
Value—4 to 6
Chroma—2 to 4
Texture—loam

Bt horizon:
Hue—10YR or 7.5YR
Value—4 to 6
Chroma—3 to 6
Texture—clay loam or loam

BC horizon:
Hue—2.5Y to 7.5YR
Value—5 or 6
Chroma—2 to 6
Texture—clay loam or loam

65E—Lindley loam, 14 to 18 percent slopes

Composition

Lindley and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 9.3 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Keswick and similar soils

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

65E2—Lindley loam, 14 to 18 percent slopes, moderately eroded

Composition

Lindley and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 9.2 inches (high)
Organic matter content of the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Keswick and similar soils
- Severely eroded areas

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

65F—Lindley loam, 18 to 25 percent slopes

Composition

Lindley and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 18 to 25 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 9.3 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in

this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Gosport and similar soils

Major Uses of the Unit

- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

65F2—Lindley loam, 18 to 25 percent slopes, moderately eroded

Composition

Lindley and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 18 to 25 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 9.2 inches (high)
Organic matter content of the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Gosport and similar soils
- Severely eroded areas

Major Uses of the Unit

- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

65G—Lindley loam, 25 to 40 percent slopes

Composition

Lindley and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 25 to 40 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 9.3 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Gosport and similar soils

Major Uses of the Unit

- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

65G2—Lindley loam, 25 to 40 percent slopes, moderately eroded

Composition

Lindley and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 25 to 40 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 9.2 inches (high)
Organic matter content of the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Gosport and similar soils
- Severely eroded areas

Major Uses of the Unit

- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Lineville Series

Drainage class: Moderately well drained
Permeability: Slow
Landform: Uplands
Parent material: Pedisediment over a reddish paleosol weathered from glacial till
Native vegetation: Mixed prairie grasses and deciduous trees
Slope range: 5 to 9 percent

Typical Pedon

Lineville silt loam, 5 to 9 percent slopes, 330 feet south and 1,270 feet west of the northeast corner of sec. 19, T. 72 N., R. 23 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; moderate very fine and fine granular structure; friable; common medium and many very fine and fine roots; slightly acid; clear smooth boundary.

E—7 to 11 inches; brown or dark brown (10YR 4/3) silt loam; 60 percent light brownish gray (10YR 6/2) dry and 40 percent pale brown (10YR 6/3) dry; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium platy structure; friable; common medium and many very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few very dark grayish brown (10YR 3/2) coatings on faces of peds; slightly acid; clear smooth boundary.

BE—11 to 15 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium platy structure parting to moderate very fine and fine subangular blocky; friable; few medium and many very fine and fine roots; few distinct brown or dark brown (10YR 4/3) clay films (cutans) on faces of peds; few fine rounded iron-manganese concretions; slightly acid; clear smooth boundary.

Bt1—15 to 19 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate very fine and fine subangular blocky structure; friable; few medium and many very fine and fine roots; few distinct brown or dark brown (10YR 4/3) clay films (cutans) on faces of peds and few light gray (10YR 7/1) coatings; few fine rounded iron-manganese concretions; slightly acid; clear smooth boundary.

2Bt2—19 to 26 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct brown or dark brown (7.5YR 4/4) mottles; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few medium and many very fine and fine roots; few distinct dark yellowish brown (10YR 4/4) clay films (cutans) on faces of peds and few light gray (10YR 7/1) coatings; common fine rounded iron-manganese concretions; neutral; 1 percent pebbles (mixed); clear smooth boundary.

2Bt3—26 to 29 inches; clay loam, 50 percent yellowish brown (10YR 5/6) and 50 percent light yellowish brown (10YR 6/4); common fine distinct brown or dark brown (7.5YR 4/4) and strong brown (7.5YR 4/6 and 5/8) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; common very fine and fine roots; pebble band at a depth of 29 inches; few distinct dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral; 10 percent pebbles (mixed); clear smooth boundary.

3Bt4—29 to 39 inches; strong brown (7.5YR 5/6) clay; many fine prominent dark reddish brown (2.5YR 3/4) and red (2.5YR 4/6) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; common very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few distinct dark yellowish brown (10YR 4/4) and brown or dark brown (7.5YR 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral; 10 percent pebbles (mixed); gradual smooth boundary.

3Bt5—39 to 47 inches; strong brown (7.5YR 5/6) clay; common fine distinct yellowish red (5YR 4/6 and 5/8) and few fine and medium prominent grayish brown (2.5Y 5/2) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; common very fine and fine roots; few distinct dark yellowish brown (10YR 4/4) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; slightly alkaline; 10 percent pebbles (mixed); gradual smooth boundary.

3Bt6—47 to 55 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct strong brown (7.5YR 4/6 and 5/8) and fine and medium grayish brown (2.5Y 5/2) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine and fine roots; few distinct dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; slightly alkaline; 10 percent pebbles (mixed); gradual smooth boundary.

3Bt7—55 to 60 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct strong brown (7.5YR 4/6 and 5/8) and few fine and medium grayish brown (2.5Y 5/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few very fine and fine roots; few faint dark yellowish brown (10YR 4/4) clay films (cutans) on faces of peds; common fine and medium rounded iron-manganese concretions; slightly alkaline.

Range in Characteristics

Thickness of the solum: Greater than 45 inches
Depth to carbonates: 72 or more inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam

E horizon:
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—silt loam

B horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silty clay loam or silt loam

2Bt horizon:
Hue—10YR or 7.5YR
Value—4 or 5
Chroma—2 or 3
Texture—clay loam or silty clay loam

3Bt horizon:
Hue—5YR to 10YR
Value—4 or 5
Chroma—4 to 6
Texture—clay or clay loam

452C—Lineville silt loam, 5 to 9 percent slopes

Composition

Lineville and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Side slopes and nose slopes
Hillslope position: Shoulders and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silt loam

Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Pedisediments over a reddish paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 10.8 inches (high)
Organic matter content of the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

452C2—Lineville silt loam, 5 to 9 percent slopes, moderately eroded

Composition

Lineville and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Side slopes and nose slopes
Hillslope position: Shoulders and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Pedisediments over a reddish paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 10.8 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Mystic Series

Drainage class: Somewhat poorly drained
Permeability: Slow
Landform: Stream terraces
Parent material: Red paleosol weathered from old valley alluvium
Native vegetation: Mixed prairie grasses and deciduous trees
Slope range: 5 to 18 percent

Typical Pedon

Mystic clay loam, 9 to 14 percent slopes, moderately eroded, 1,120 feet east and 1,430 feet south of the northwest corner of sec. 5, T. 72 N., R. 22 W.

Ap—0 to 5 inches; clay loam, 85 percent very dark grayish brown (10YR 3/2) and 15 percent dark yellowish brown (10YR 4/4); 60 percent grayish brown (10YR 5/2) dry and 40 percent light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; common fine roots; few faint very dark gray (10YR 3/1) organic coatings on faces of peds; neutral; clear smooth boundary.

BE—5 to 9 inches; brown or dark brown (10YR 4/3), dark grayish brown (10YR 4/2) exterior clay loam; few fine distinct yellowish brown (10YR 5/6) and common prominent reddish brown (5YR 4/4) mottles; moderate fine subangular blocky structure parting to moderate fine granular; friable; common fine roots; few distinct very dark gray (10YR 3/1) organic coatings on faces of peds; neutral; clear smooth boundary.

Bt1—9 to 15 inches; brown or dark brown (10YR 4/3) clay; common fine prominent red (2.5YR 4/6) and distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; distinct dark grayish brown (10YR 4/2) and dark gray (10YR 4/1) clay films (cutans) on faces of peds; common fine rounded dark concretions; neutral; 1 percent pebbles; gradual smooth boundary.

Bt2—15 to 24 inches; brown (10YR 5/3) clay; common fine prominent dark yellowish brown (10YR 4/6) and many yellowish brown (10YR 5/8) mottles; weak medium prismatic structure parting to moderate very fine and fine subangular blocky; firm; few fine roots; few prominent grayish brown (2.5Y 5/2) clay films (cutans) on faces of peds; common fine rounded dark concretions; neutral; gradual smooth boundary.

Bt3—24 to 31 inches; yellowish brown (10YR 5/6) clay loam; few fine prominent yellowish red (5YR 4/6) mottles; moderate fine and medium prismatic structure; firm; few fine roots; few distinct dark grayish brown (10YR 4/2) clay films (cutans) in root channels, pores, or both; few grayish brown (10YR 5/2) clay films (cutans) on faces of peds; common fine rounded dark concretions; neutral; gradual smooth boundary.

Bt4—31 to 41 inches; clay loam, 80 percent yellowish brown (10YR 5/8) and 20 percent strong brown (7.5YR 5/8); many medium prominent weak red (2.5YR 5/2) and pale red (2.5YR 6/2) mottles; moderate fine and medium prismatic structure; friable; few distinct dark grayish brown (10YR 4/2) clay films (cutans) in root channels, pores, or both; common fine rounded dark concretions; neutral; 1 percent pebbles; gradual smooth boundary.

Bt5—41 to 51 inches; yellowish brown (10YR 5/8) and brownish yellow (10YR 6/8) clay loam; many medium distinct grayish brown (10YR 5/2) and common prominent strong brown (7.5YR 5/6) mottles; moderate fine and medium prismatic structure; friable; pebble band 1/4 to 1/2 inch in diameter at a depth of 51 inches; few distinct brown or dark brown (10YR 4/3) clay films (cutans) on faces of peds and few brown or dark brown (10YR 4/3) clay films (cutans) in root channels, pores, or both; common fine and medium rounded dark concretions; neutral; 1 percent pebbles; clear smooth boundary.

C—51 to 60 inches; yellowish brown (10YR 5/8 and 5/6) sandy clay loam; common fine distinct light brownish gray (10YR 6/2) and many prominent strong brown (7.5YR 4/6) mottles; massive; friable; common fine and medium rounded dark concretions; neutral; 1 percent pebbles.

Range in Characteristics

Thickness of the solum: 45 to 60 inches
Depth to carbonates: Greater than 60 inches

A horizon:
Hue—10YR
Value—3
Chroma—1 or 2
Texture—silt loam to clay loam

Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 4
Texture—clay or clay loam

C horizon:
Hue—7.5YR or 10YR
Value—4 to 6
Chroma—2 to 8
Texture—sandy clay loam to sandy loam

94D2—Mystic-Caleb complex, 9 to 14 percent slopes, moderately eroded

Composition

Mystic and similar soils: About 60 percent
Caleb and similar soils: About 40 percent

Setting

Landform: Stream terraces
Geomorphic component: Side slopes
Hillslope position: Shoulders and backslopes
Slope: 9 to 14 percent

Component Description

Mystic

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Old valley alluvium
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 10.7 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

Caleb

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Old valley alluvium
Flooding: None
Depth to the water table: 3 to 5 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.3 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

94E2—Mystic-Caleb complex, 14 to 18 percent slopes, moderately eroded

Composition

Mystic and similar soils: About 60 percent
Caleb and similar soils: About 35 percent
Inclusions: About 5 percent

Setting

Landform: Stream terraces
Geomorphic component: Side slopes
Hillslope position: Shoulders and backslopes
Slope: 14 to 18 percent

Component Description

Mystic

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Old valley alluvium
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 10.7 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

Caleb

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Old valley alluvium
Flooding: None
Depth to the water table: 3 to 5 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.3 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a thicker surface layer than the major soils
- Severely eroded areas

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

592C2—Mystic clay loam, 5 to 9 percent slopes, moderately eroded

Composition

Mystic and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Stream terraces
Geomorphic component: Side slopes
Hillslope position: Shoulders and backslopes

Slope: 5 to 9 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Reddish paleosol weathered from old valley alluvium
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 10.7 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Caleb and similar soils
- Severely eroded areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

592D2—Mystic clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Mystic and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Stream terraces
Geomorphic component: Side slopes
Hillslope position: Shoulders and backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Reddish paleosol weathered from old valley alluvium
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 10.7 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a thinner surface layer than the Mystic soil
- Severely eroded areas
- Soils that have more sand than the Mystic soil

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Nodaway Series

Drainage class: Moderately well drained
Permeability: Moderate
Landform: Flood plains
Parent material: Silty alluvium
Native vegetation: Mixed prairie grasses and deciduous trees
Slope range: 0 to 2 percent

Typical Pedon

Nodaway silt loam, 0 to 2 percent slopes, 1,450 feet north and 115 feet west of the southeast corner of sec. 21, T. 72 N., R. 23 W.

Ap—0 to 8 inches; silt loam, 80 percent very dark grayish brown (10YR 3/2) and 20 percent grayish brown (10YR 5/2); 80 percent grayish brown (10YR 5/2) dry and 20 percent light gray (10YR 7/2) dry; weak fine granular structure; friable;

common medium and many very fine and fine roots; neutral; abrupt smooth boundary.

C1—8 to 13 inches; very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), and pale brown (10YR 6/3) silt loam; massive; friable; common medium and many very fine and fine roots; neutral; abrupt smooth boundary.

C2—13 to 39 inches; dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2), and brown (10YR 5/3) silt loam; massive; friable; many medium roots; neutral; abrupt smooth boundary.

C3—39 to 60 inches; very dark gray (10YR 3/1), brown (10YR 5/3), and pale brown (10YR 6/3) silt loam; massive; friable; few medium and common very fine and fine roots; slightly alkaline.

Range in Characteristics

Thickness of the solum: 6 to 10 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam

C horizon:
Hue—10YR
Value—3 or 4
Chroma—1 to 3
Texture—silt loam

220—Nodaway silt loam, 0 to 2 percent slopes

Composition

Nodaway and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Silty alluvium
Frequency of flooding: Occasional
Depth to the water table: 3 to 5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.9 inches (high)
Organic matter content of the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Areas of poorly drained soils
- Lawson and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

711—Nodaway-Lawson complex, 0 to 2 percent slopes

Composition

Nodaway and similar soils: About 70 percent
Lawson and similar soils: About 30 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Nodaway

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Alluvium
Frequency of flooding: Occasional
Depth to the water table: 3 to 5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.9 inches (high)
Organic matter content of the surface layer: About 3.7 percent (moderate)

Lawson

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium

Frequency of flooding: Occasional
Depth to the water table: 1 to 3 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.0 inches (high)
Organic matter content of the surface layer: About 3.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Areas of poorly drained soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

1711—Nodaway-Lawson complex, channeled, 0 to 2 percent slopes

Composition

Nodaway and similar soils: About 70 percent
Lawson and similar soils: About 30 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Nodaway

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Alluvium
Frequency of flooding: Frequent
Depth to the water table: 3 to 5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.9 inches (high)
Organic matter content of the surface layer: About 3.7 percent (moderate)

Lawson

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Frequency of flooding: Frequent
Depth to the water table: 1 to 3 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.0 inches (high)
Organic matter content of the surface layer: About 3.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Oxbows
- Depressional areas

Major Uses of the Unit

- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Olmitz Series

Drainage class: Moderately well drained
Permeability: Moderate
Landform: Upland drainageways and alluvial fans
Parent material: Local alluvium
Native vegetation: Prairie grasses
Slope range: 2 to 9 percent

Typical Pedon

Olmitz loam, 2 to 5 percent slopes, 1,600 feet north and 840 feet west of the southeast corner of sec. 15, T. 72 N., R. 23 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, dark grayish brown (10YR 4/2) dry; moderate very fine and fine granular structure; friable; common medium and many very fine and fine roots; moderately acid; clear smooth boundary.

A1—8 to 16 inches; black (10YR 2/1) and very dark brown (10YR 2/2) clay loam; very dark grayish

brown (10YR 3/2) dry; weak very fine and fine subangular blocky structure parting to moderate fine granular; friable; common medium and many very fine and fine roots; strongly acid; 1 percent pebbles (mixed); gradual smooth boundary.

A2—16 to 25 inches; very dark brown (10YR 2/2) clay loam, very dark grayish brown (10YR 3/2) dry; moderate very fine and fine subangular blocky structure; friable; few medium and many very fine and fine roots; moderately acid; 10 percent pebbles (mixed); gradual smooth boundary.

A3—25 to 33 inches; very dark grayish brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; moderate fine prismatic structure parting to moderate fine subangular blocky; friable; few medium and many very fine and fine roots; few very dark brown (10YR 2/2) organic coatings on faces of peds; slightly acid; 10 percent pebbles (mixed); gradual smooth boundary.

AB—33 to 38 inches; dark brown (10YR 3/3) clay loam, grayish brown (10YR 5/2) dry; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; friable; few medium and common very fine and fine roots; few very dark grayish brown (10YR 3/2) organic coatings on faces of peds; slightly acid; 10 percent pebbles (mixed); clear smooth boundary.

Bw1—38 to 44 inches; brown or dark brown (10YR 4/3) clay loam; weak medium prismatic structure parting to moderate fine and medium subangular blocky; friable; few medium and common very fine and fine roots; few dark brown (10YR 3/3) organic coatings on faces of peds; few fine rounded iron-manganese concretions; slightly acid; 10 percent pebbles (mixed); clear smooth boundary.

Bw2—44 to 51 inches; brown or dark brown (10YR 4/3) clay loam; weak medium prismatic structure parting to moderate fine and medium subangular blocky; friable; few medium and common very fine and fine roots; few dark brown (10YR 3/3) organic coatings on faces of peds; common fine rounded iron-manganese concretions; neutral; 10 percent pebbles (mixed); gradual smooth boundary.

Bw3—51 to 60 inches; brown or dark brown (10YR 4/3) clay loam; weak medium prismatic structure parting to moderate fine and medium subangular blocky; friable; common very fine and fine roots; common fine rounded iron-manganese concretions; neutral; 10 percent pebbles (mixed).

Range in Characteristics

Thickness of the solum: 40 to 60 inches
Thickness of the mollic epipedon: 24 to 40 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam or clay loam

Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—clay loam

273B—Olmitz loam, 2 to 5 percent slopes

Composition

Olmitz and similar soils: 100 percent

Setting

Landform: Alluvial fans
Geomorphic component: Base slopes
Hillslope position: Footslopes
Slope: 2 to 5 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Local alluvium
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.7 inches (high)
Organic matter content of the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

• Agronomy section

273C—Olmitz loam, 5 to 9 percent slopes

Composition

Olmitz and similar soils: 100 percent

Setting

Landform: Alluvial fans
Geomorphic component: Base slopes
Hillslope position: Footslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Local alluvium
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.7 inches (high)
Organic matter content of the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

• Cropland
• Hayland
• Pasture

For general and detailed information concerning these uses, see Part II of this publication:

• Agronomy section

5021—Orthents, hilly

Component Description

Surface layer texture: Loam
Flooding: None
General information: This map unit consists of rolling to hilly areas from which soil material has been removed for use in other areas.

Major Uses of the Unit

• Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

• Wildlife Habitat section

5040—Orthents, loamy

Component Description

Surface layer texture: Loam
Flooding: None
General information: This map unit consists of nearly level and undulating areas from which soil material has been removed for use in other areas.

Major Uses of the Unit

• Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

• Wildlife Habitat section

Pershing Series

Drainage class: Somewhat poorly drained
Permeability: Slow
Landform: Uplands and stream terraces
Parent material: Loess
Native vegetation: Mixed prairie grasses and deciduous trees
Slope range: 2 to 14 percent

Typical Pedon

Pershing silt loam, 5 to 9 percent slopes, 230 feet south and 190 feet east of the northwest corner of sec. 31, T. 72 N., R. 21 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam; 70 percent gray (10YR 5/1) dry and 30 percent grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; few medium and many very fine and fine roots; neutral; clear smooth boundary.

E—8 to 11 inches; dark grayish brown (10YR 4/2) silt loam; 70 percent light brownish gray (10YR 6/2) dry and 30 percent gray (10YR 5/1) dry; common fine distinct yellowish brown (10YR 5/4) mottles; moderate medium platy structure; friable; few medium and many very fine and fine roots; few very dark grayish brown (10YR 3/2) organic coatings in root channels, pores, or both; few very dark grayish brown (10YR 3/2) organic coatings on faces of peds; few fine rounded iron-

manganese concretions; slightly acid; clear smooth boundary.

Bt1—11 to 15 inches; yellowish brown (10YR 5/4) silty clay loam; moderate very fine and fine subangular blocky structure; friable; few medium and many very fine and fine roots; few very dark grayish brown (10YR 3/2) organic coatings in root channels, pores, or both; few distinct dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds and few light gray (10YR 7/1) coatings; common fine rounded iron-manganese concretions; moderately acid; clear smooth boundary.

Bt2—15 to 20 inches; silty clay, 50 percent yellowish brown (10YR 5/4) and 50 percent grayish brown (10YR 5/2); common fine distinct strong brown (7.5YR 4/6 and 5/8) and brown or dark brown (7.5YR 4/4) mottles; moderate fine subangular blocky structure; very firm; few medium and many very fine and fine roots; few distinct very dark grayish brown (10YR 3/2) organic coatings in root channels, pores, or both; few dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds and few light gray (10YR 7/1) coatings; common fine rounded iron-manganese concretions; moderately acid; clear smooth boundary.

Btg1—20 to 27 inches; grayish brown (10YR 5/2) silty clay; common fine distinct brown or dark brown (7.5YR 4/4) and strong brown (7.5YR 4/6 and 5/8) mottles; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; few medium and common very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few distinct dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; moderately acid; gradual smooth boundary.

Btg2—27 to 34 inches; grayish brown (2.5Y 5/2) silty clay; common fine faint light brownish gray (2.5Y 6/2) and prominent brown or dark brown (7.5YR 4/4) and strong brown (7.5YR 4/6 and 5/8) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few medium and common very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few distinct dark grayish brown (2.5Y 4/2) clay films (cutans) on faces of peds; many fine and medium rounded iron-manganese concretions; slightly acid; gradual smooth boundary.

Btg3—34 to 45 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine and medium prominent brown or dark brown (7.5YR 4/4) and strong brown (7.5YR 4/6 and 5/8) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few medium and common very fine and fine roots; very few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few distinct dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) clay films (cutans) on faces of peds; common fine and medium rounded iron-manganese concretions; neutral; gradual smooth boundary.

Btg4—45 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; many fine and medium prominent brown or dark brown (7.5YR 4/4) and strong brown (7.5YR 4/6 and 5/8) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; few very fine and fine roots; very few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few faint grayish brown (2.5Y 5/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral.

Range in Characteristics

Thickness of the solum: 48 to 60 inches

A horizon:
Hue—10YR
Value—3
Chroma—1 or 2
Texture—silt loam or silty clay loam

E horizon:
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—silt loam

Bt horizon:
Hue—10YR
Value—4 to 6
Chroma—2 to 6
Texture—silty clay or silty clay loam

Btg or C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 6
Texture—silt loam or silty clay loam

131B—Pershing silt loam, 2 to 5 percent slopes

Composition

Pershing and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves
Hillslope position: Summits and shoulders
Slope: 2 to 5 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches (high)
Organic matter content of the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Areas of poorly drained soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

131C—Pershing silt loam, 5 to 9 percent slopes

Composition

Pershing and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches (high)
Organic matter content of the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

131C2—Pershing silty clay loam, 5 to 9 percent slopes, moderately eroded

Composition

Pershing and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 11.7 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

131D2—Pershing silty clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Pershing and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 11.7 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

831B—Pershing silt loam, bench, 2 to 5 percent slopes

Composition

Pershing and similar soils: 100 percent

Setting

Landform: Stream terraces
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 5 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches (high)
Organic matter content of the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this

map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

831C—Pershing silt loam, bench, 5 to 9 percent slopes

Composition

Pershing and similar soils: 100 percent

Setting

Landform: Stream terraces
Geomorphic component: Side slopes
Hillslope position: Shoulders and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches (high)
Organic matter content of the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

831C2—Pershing silty clay loam, bench, 5 to 9 percent slopes, moderately eroded

Composition

Pershing and similar soils: 100 percent

Setting

Landform: Stream terraces
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Shoulders and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 11.7 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Rinda Series

Drainage class: Poorly drained
Permeability: Very slow

Landform: Uplands
Parent material: Gray paleosol weathered from glacial till
Native vegetation: Mixed prairie grasses and deciduous trees
Slope range: 5 to 14 percent

Typical Pedon

Rinda silty clay loam, 5 to 9 percent slopes, moderately eroded, 1,220 feet north and 2,800 feet west of the southeast corner of sec. 14, T. 72 N., R. 21 W.

Ap—0 to 7 inches; 75 percent very dark grayish brown (10YR 3/2), very dark gray (10YR 3/1) exterior, and 25 percent brown or dark brown (10YR 4/3) silty clay loam; gray (10YR 5/1) dry; weak very fine and fine subangular blocky structure parting to weak fine granular; friable; common fine roots; neutral; clear smooth boundary.

Bt—7 to 11 inches; brown or dark brown (10YR 4/3) silty clay; weak medium subangular blocky structure parting to moderate fine subangular blocky; firm; common fine roots; few very dark grayish brown (10YR 3/2) organic coatings on faces of peds; few distinct dark yellowish brown (10YR 4/4) clay films (cutans) and prominent strong brown (7.5YR 4/6) coatings in root channels, pores, or both; slightly acid; clear smooth boundary.

Btg1—11 to 16 inches; grayish brown (10YR 5/2) clay; common fine distinct yellowish brown (10YR 5/6) and few prominent strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very firm; common fine roots; few distinct dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; few fine rounded iron-manganese concretions; slightly acid; gradual smooth boundary.

Btg2—16 to 22 inches; grayish brown (2.5Y 5/2) clay; common fine distinct yellowish brown (10YR 5/8) and few prominent strong brown (7.5YR 4/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very firm; common fine roots; few distinct dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; moderately acid; gradual smooth boundary.

Btg3—22 to 35 inches; light brownish gray (2.5Y 6/2) clay; common fine prominent strong brown (7.5YR 5/6) and yellowish brown (10YR 5/8) mottles; moderate medium and coarse prismatic structure; very firm; few fine roots; few distinct grayish brown (10YR 5/2) clay films (cutans) on faces of peds; few fine rounded iron-manganese concretions; slightly acid; gradual smooth boundary.

Btg4—35 to 47 inches; clay, 50 percent light brownish gray (2.5Y 6/2) and 50 percent grayish brown (2.5Y 5/2); common fine prominent yellowish brown (10YR 5/8) and few strong brown (7.5YR 5/6) mottles; moderate medium and coarse prismatic structure; very firm; few fine roots; few faint dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; few fine rounded iron-manganese concretions; neutral; gradual smooth boundary.

Btg5—47 to 60 inches; silty clay, 50 percent light brownish gray (2.5Y 6/2) and 50 percent grayish brown (2.5Y 5/2); common medium prominent yellowish brown (10YR 5/8) mottles; weak coarse prismatic structure; very firm; few fine roots; few faint dark grayish brown (10YR 4/2) clay films (cutans) on faces of peds; few black (10YR 2/1) coatings in root channels, pores, or both; common fine and medium irregular iron-manganese concretions; neutral.

Range in Characteristics

Thickness of the solum: Greater than 60 inches

A horizon:
Hue—10YR
Value—3
Chroma—1 or 2
Texture—silty clay loam

E horizon (if it occurs):
Hue—10YR
Value—4 or 5
Chroma—2
Texture—silt loam or silty clay loam

Btg horizon:
Hue—10YR to 5Y
Value—4 to 6
Chroma—1 or 2
Texture—silty clay or clay

223C2—Rinda silty clay loam, 5 to 9 percent slopes, moderately eroded

Composition

Rinda and similar soils: 100 percent

Setting

Landform: Uplands

Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Shoulders and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Gray paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.6 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

223D2—Rinda silty clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Rinda and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Gray paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.6 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Shelby Series

Drainage class: Well drained
Permeability: Moderately slow
Landform: Uplands
Parent material: Glacial till
Native vegetation: Prairie grasses
Slope range: 9 to 25 percent

Typical Pedon

Shelby clay loam, 9 to 14 percent slopes, 30 feet south and 495 feet west of the northeast corner of sec. 14, T. 71 N., R. 20 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) clay loam, dark grayish brown (10YR 4/2) dry; moderate very fine and fine granular structure; friable; common medium and many very fine and fine roots; neutral; 1 percent pebbles (mixed); clear smooth boundary.

A—8 to 11 inches; very dark brown (10YR 2/2) clay loam; 70 percent dark grayish brown (10YR 4/2) dry and 30 percent brown (10YR 5/3) dry; moderate very fine and fine granular structure; friable; few medium and many very fine and fine roots; neutral; 1 percent pebbles (mixed); clear smooth boundary.

BA—11 to 15 inches; clay loam, 50 percent dark yellowish brown (10YR 4/4) and 50 percent very dark grayish brown (10YR 3/2); common fine distinct dark yellowish brown (10YR 4/6) mottles; moderate very fine and fine subangular blocky structure; friable; few medium and many very fine and fine roots; few very dark brown (10YR 2/2) organic coatings on faces of peds and few distinct brown or dark brown (10YR 4/3) clay films (cutans); few fine rounded iron-manganese concretions; slightly acid; 5 percent pebbles (mixed); clear smooth boundary.

Bt1—15 to 20 inches; dark yellowish brown (10YR 4/4) clay loam; common fine distinct dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/8) mottles; moderate very fine and fine subangular blocky structure; firm; many very fine and fine roots; few very dark grayish brown (10YR 3/2) organic coatings on faces of peds and few distinct brown or dark brown (10YR 4/3) clay films (cutans); common fine rounded iron-manganese concretions; moderately acid; 5 percent pebbles (mixed); gradual smooth boundary.

Bt2—20 to 28 inches; dark yellowish brown (10YR 4/4) clay loam; common fine distinct strong brown (7.5YR 4/6 and 5/8) and few grayish brown (10YR 5/2) mottles; moderate fine and medium prismatic structure parting to moderate fine subangular blocky; firm; many very fine and fine roots; few distinct brown or dark brown (10YR 4/3) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral; 6 percent pebbles (mixed); gradual smooth boundary.

Bt3—28 to 38 inches; clay loam, 50 percent dark yellowish brown (10YR 4/4) and 50 percent yellowish brown (10YR 5/4); common fine distinct strong brown (7.5YR 4/6 and 5/8) and grayish brown (2.5Y 5/2) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; common very fine and fine roots; few distinct brown or dark brown (10YR 4/3) and dark yellowish brown (10YR 4/4) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral; 6 percent pebbles (mixed); gradual smooth boundary.

Bt4—38 to 48 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct brown or dark brown (7.5YR 4/4), strong brown (7.5YR 4/6 and 5/8), and grayish brown (2.5Y 5/2) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; common very fine and fine roots; few distinct dark yellowish brown (10YR 4/4) and brown or dark brown (10YR 4/3) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; neutral; 6 percent pebbles (mixed); gradual smooth boundary.

Bt5—48 to 56 inches; clay loam, 50 percent yellowish brown (10YR 5/4) and 50 percent grayish brown (2.5Y 5/2); many fine distinct strong brown (7.5YR 4/6 and 5/8) and brown or dark brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine and fine roots; few distinct brown or dark brown (10YR 4/3) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; slightly alkaline; 6 percent pebbles (mixed); gradual smooth boundary.

BC—56 to 60 inches; clay loam, 50 percent grayish brown (2.5Y 5/2) and 50 percent yellowish brown (10YR 5/4); many fine distinct strong brown (7.5YR 4/6 and 5/8) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few very fine and fine roots; few faint brown (10YR 5/3) and dark brown (10YR 4/3) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions and few fine irregular lime nodules; slightly effervescent; moderately alkaline; 7 percent pebbles.

Range in Characteristics

Thickness of the solum: 45 to 60 inches
Thickness of the mollic epipedon: 10 to 16 inches
Depth to carbonates: 30 to 60 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam or clay loam

Bt horizon:
Hue—10YR
Value—3 to 6
Chroma—3 to 6
Texture—loam or clay loam

BC horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 6
Texture—clay loam or loam

24D—Shelby clay loam, 9 to 14 percent slopes

Composition

Shelby and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Organic matter content of the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

24D2—Shelby clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Shelby and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Organic matter content of the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

24E2—Shelby clay loam, 14 to 18 percent slopes, moderately eroded

Composition

Shelby and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)

Organic matter content of the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Adair and similar soils
- Severely eroded areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

24E3—Shelby clay loam, 14 to 18 percent slopes, severely eroded

Composition

Shelby and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Organic matter content of the surface layer: About 1.7 percent (moderately low)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Adair and similar soils
- Soils that have a thicker surface layer than the Shelby soil

Major Uses of the Unit

- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

24F2—Shelby clay loam, 18 to 25 percent slopes, moderately eroded

Composition

Shelby and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 18 to 25 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Organic matter content of the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Hayland
- Pasture

For general and detailed information concerning

these uses, see Part II of this publication:

- Agronomy section

93D2—Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded

Composition

Shelby and similar soils: About 60 percent
Adair and similar soils: About 40 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Shelby

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Organic matter content of the surface layer: About 2.7 percent (moderate)

Adair

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.1 inches (high)
Organic matter content of the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

5025—Strip mines, dumps

Component Description

Surface layer texture: Unweathered bedrock
Flooding: None
Depth to the water table: Greater than 6.0 feet
General information: This map unit consists of areas of mines and dumps where bedrock has been removed.

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Tuskeego Series

Drainage class: Poorly drained
Permeability: Very slow
Landform: Stream terraces
Parent material: Silty alluvium
Native vegetation: Mixed prairie grasses and deciduous trees
Slope range: 0 to 2 percent

Typical Pedon

Tuskeego silt loam, 0 to 2 percent slopes, 1,980 feet east and 1,490 feet north of the southwest corner of sec. 11, T. 71 N., R. 23 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; weak fine and medium subangular blocky structure parting to moderate fine granular; friable; common very fine and fine roots; moderately acid; clear smooth boundary.

E1—9 to 15 inches; grayish brown (10YR 5/2) silt loam, light brownish gray (10YR 6/2) and light gray or gray (10YR 6/1) dry; few fine distinct yellowish brown (10YR 5/6) mottles; weak thin platy structure parting to weak fine subangular blocky; friable; common fine roots; common distinct dark grayish brown (10YR 4/2) coatings on faces of peds; few fine rounded iron-

manganese concretions; slightly acid; clear smooth boundary.

E2—15 to 20 inches; grayish brown (2.5Y 5/2) silt loam, light gray (10YR 7/2) dry; common fine prominent yellowish brown (10YR 5/6) mottles; weak thick platy structure parting to weak fine subangular blocky; friable; few fine roots; few distinct very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few grayish brown (10YR 5/2) coatings on faces of peds; slightly acid; clear smooth boundary.

Btg1—20 to 25 inches; silty clay loam, 60 percent grayish brown (2.5Y 5/2) and 40 percent very dark gray (10YR 3/1); common fine prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few prominent very dark gray (10YR 3/1) clay films (cutans) on faces of peds and few grayish brown (10YR 5/2) coatings in root channels, pores, or both; slightly acid; gradual smooth boundary.

Btg2—25 to 32 inches; grayish brown (2.5Y 5/2) silty clay; many fine prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; few distinct very dark gray (10YR 3/1) organic coatings on faces of peds and few dark gray (10YR 4/1) clay films (cutans); neutral; gradual smooth boundary.

Btg3—32 to 40 inches; grayish brown (2.5Y 5/2) silty clay loam; many fine distinct yellowish brown (10YR 5/6) and few prominent strong brown (7.5YR 4/6) mottles; weak fine and medium prismatic structure; firm; few faint grayish brown (10YR 5/2) clay films (cutans) on faces of peds; common fine irregular iron-manganese concretions; neutral; gradual smooth boundary.

Btg4—40 to 53 inches; light brownish gray (2.5Y 6/2) silty clay loam; many fine and medium prominent yellowish brown (10YR 5/6) and common fine strong brown (7.5YR 4/6) mottles; weak medium prismatic structure; firm; few faint light gray or gray (10YR 6/1) clay films (cutans) on faces of peds; common fine irregular iron-manganese concretions; neutral; gradual smooth boundary.

Btg5—53 to 60 inches; silty clay loam, 55 percent light brownish gray (2.5Y 6/2) and 45 percent strong brown (7.5YR 5/6); weak medium prismatic structure; friable; very few faint light gray or gray (10YR 6/1) clay films (cutans) on faces of peds; common fine irregular iron-manganese concretions; neutral.

Range in Characteristics

Thickness of the solum: 48 to 60 inches

A horizon:
Hue—10YR
Value—3
Chroma—2 or 3
Texture—silt loam

E horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—1 or 2
Texture—silt loam

Btg horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—1 or 2
Texture—silty clay or silty clay loam

453—Tuskeego silt loam, 0 to 2 percent slopes

Composition

Tuskeego and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Stream terraces
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Silty alluvium
Frequency of flooding: Rare
Water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.8 inches (high)
Organic matter content of the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Humeston and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Vesser Series

Drainage class: Somewhat poorly drained
Permeability: Moderate
Landform: Alluvial fans, flood plains, and upland drainageways
Parent material: Alluvium
Native vegetation: Prairie grasses
Slope range: 0 to 5 percent

Typical Pedon

Vesser silt loam, 0 to 2 percent slopes, 1,650 feet south and 1,480 feet west of the northeast corner of sec. 25, T. 72 N., R. 22 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam; 70 percent dark gray (10YR 4/1) dry and 30 percent gray (10YR 5/1) dry; moderate fine granular structure; friable; few coarse, common medium, and many very fine and fine roots; neutral; clear smooth boundary.

A—9 to 14 inches; brown or dark brown (10YR 4/3), very dark gray (10YR 3/1) exterior silt loam; gray (10YR 5/1) dry; moderate very fine and fine granular structure; friable; few coarse, common medium, and many very fine and fine roots; moderately acid; clear smooth boundary.

E1—14 to 19 inches; dark gray (10YR 4/1) silt loam; 70 percent gray (10YR 5/1) dry and 30 percent light gray or gray (10YR 6/1) dry; common fine distinct brown or dark brown (7.5YR 4/4) and dark yellowish brown (10YR 4/6) mottles; moderate medium platy structure parting to moderate thin platy; friable; common medium and many very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few dark grayish brown (10YR 4/2) coatings on faces of peds; common fine rounded iron-manganese concretions; moderately acid; clear smooth boundary.

E2—19 to 26 inches; silt loam, 50 percent dark gray (10YR 4/1) and 50 percent gray (10YR 5/1); 50 percent light gray (10YR 7/1) dry and 50 percent grayish brown (10YR 5/2) dry; many fine distinct dark yellowish brown (10YR 4/6) and brown or dark brown (7.5YR 4/4) mottles; moderate medium platy structure parting to moderate thin platy; friable; few medium and many very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few dark gray (10YR 4/1) coatings on faces of peds; common fine rounded iron-manganese concretions; moderately acid; clear smooth boundary.

E3—26 to 33 inches; gray (10YR 5/1) silt loam; 70 percent light gray (10YR 7/1) dry and 30 percent light brownish gray (10YR 6/2) dry; common fine distinct brown or dark brown (7.5YR 4/4) and dark yellowish brown (10YR 4/6) mottles; moderate thick platy structure parting to moderate medium platy; friable; few medium and many very fine and fine roots; few faint dark grayish brown (10YR 4/2) organic coatings on faces of peds and few light gray (10YR 7/1) coatings; common fine rounded iron-manganese concretions; moderately acid; clear smooth boundary.

Btg1—33 to 40 inches; dark gray (10YR 4/1) silty clay loam; common fine distinct brown or dark brown (7.5YR 4/4) and strong brown (7.5YR 4/6 and 5/8) mottles; moderate medium prismatic structure; friable; few medium and many very fine and fine roots; few distinct very dark gray (10YR 3/1) organic coatings on faces of peds, few dark grayish brown (10YR 4/2) clay films (cutans), and few light gray (10YR 7/1) coatings; common fine rounded iron-manganese concretions; moderately acid; gradual smooth boundary.

Btg2—40 to 47 inches; silty clay loam, 50 percent grayish brown (2.5Y 5/2) and 50 percent gray (10YR 5/1); common fine distinct brown or dark brown (7.5YR 4/4) and strong brown (7.5YR 4/6 and 5/8) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few medium and common very fine and fine roots; few distinct very dark gray (10YR 3/1) organic coatings on faces of peds, few dark grayish brown (10YR 4/2) clay films (cutans), and few light gray (10YR 7/1) coatings; common fine rounded iron-manganese concretions; moderately acid; gradual smooth boundary.

Btg3—47 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct brown or dark brown (7.5YR 4/4) and strong brown (7.5YR 4/6 and 5/8) mottles; moderate medium prismatic

structure parting to moderate fine and medium subangular blocky; firm; common very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few distinct dark grayish brown (2.5Y 4/2) clay films (cutans) on faces of peds; common fine rounded iron-manganese concretions; moderately acid.

Range in Characteristics

Thickness of the solum: Greater than 60 inches
Thickness of the mollic epipedon: 10 to 14 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam

E horizon:
Hue—10YR
Value—3 to 5
Chroma—1 or 2
Texture—silt loam

Btg horizon:
Hue—10YR or 2.5Y
Value—3 to 5
Chroma—1 or 2
Texture—silty clay loam

51—Vesser silt loam, 0 to 2 percent slopes

Composition

Vesser and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Frequency of flooding: Occasional
Depth to the water table: 1 to 3 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.0 inches (high)
Organic matter content of the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

• Soils that have a surface layer of loam
• Soils that have a thinner surface layer than the Vesser soil

Major Uses of the Unit

• Cropland
• Hayland
• Pasture

For general and detailed information concerning these uses, see Part II of this publication:

• Agronomy section

51+—Vesser silt loam, 0 to 2 percent slopes, overwash

Composition

Vesser and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Frequency of flooding: Occasional
Depth to the water table: 1 to 3 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.0 inches (high)
Organic matter content of the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

• Soils that have a surface layer of loam

• Soils that have a thinner surface layer than the Vesser soil

Major Uses of the Unit

• Cropland
• Hayland
• Pasture

For general and detailed information concerning these uses, see Part II of this publication:

• Agronomy section

51B—Vesser silt loam, 2 to 5 percent slopes

Composition

Vesser and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Alluvial fans
Geomorphic component: Base slopes
Hillslope position: Footslopes
Slope: 2 to 5 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.0 inches (high)
Organic matter content of the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

• Humeston and similar soils
• Soils that have more sand than the Vesser soil
• Soils that have a thinner surface layer than the Vesser soil

Major Uses of the Unit

• Cropland
• Hayland
• Pasture

For general and detailed information concerning these uses, see Part II of this publication:

• Agronomy section

51B+—Vesser silt loam, 2 to 5 percent slopes, overwash

Composition

Vesser and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Alluvial fans
Geomorphic component: Base slopes
Hillslope position: Footslopes
Slope: 2 to 5 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.0 inches (high)
Organic matter content of the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

• Humeston and similar soils

Major Uses of the Unit

• Cropland
• Hayland
• Pasture

For general and detailed information concerning these uses, see Part II of this publication:

• Agronomy section

Wabash Series

Drainage class: Poorly drained
Permeability: Very slow
Landform: Flood plains
Parent material: Silty alluvium
Native vegetation: Prairie grasses and trees
Slope range: 0 to 2 percent

Typical Pedon

Wabash silty clay, 0 to 2 percent slopes, 475 feet north and 600 feet west of the southeast corner of sec. 9, T. 71 N., R. 22 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay, dark gray (N 4/0) dry; moderate very fine and fine granular structure; firm; common medium and many very fine and fine roots; neutral; clear smooth boundary.

A1—8 to 18 inches; black (N 2/0) silty clay, dark gray (N 4/0) dry; moderate very fine and fine subangular blocky structure; very firm; common medium and many very fine and fine roots; few fine threads and wormcasts; neutral; gradual smooth boundary.

A2—18 to 24 inches; black (N 2/0) silty clay, dark gray (N 4/0) dry; moderate fine prismatic structure parting to moderate fine and medium subangular blocky; very firm; common medium and many very fine and fine roots; common fine threads and wormcasts; neutral; gradual smooth boundary.

A3—24 to 32 inches; black (10YR 2/1) silty clay, gray (N 5/0) dry; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; common medium and many very fine and fine roots; few fine rounded iron-manganese concretions; neutral; gradual smooth boundary.

Bg1—32 to 42 inches; very dark gray (10YR 3/1) silty clay; common fine distinct grayish brown (2.5Y 5/2) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very firm; few medium and many very fine and fine roots; few very dark gray (10YR 3/1) organic coatings on faces of peds and in root channels, pores, or both; few black (10YR 2/1) pressure faces; common fine rounded iron-manganese concretions; neutral; gradual smooth boundary.

Bg2—42 to 52 inches; dark gray (5Y 4/1) silty clay loam; common fine distinct grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/6) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; very dark gray (10YR 3/1 and 5Y 3/1) pressure faces on faces of peds; neutral; gradual smooth boundary.

BCg—52 to 60 inches; gray (5Y 5/1) silty clay loam; common fine distinct grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few very fine and fine roots; few very dark gray (10YR 3/1) organic coatings in root channels, pores, or both; few distinct dark gray (5Y 4/1) pressure faces; few fine rounded iron-manganese concretions; neutral.

Range in Characteristics

Thickness of the solum: 40 to 60 inches
Thickness of the mollic epipedon: 24 to 45 inches

A horizon:
Hue—10YR, 2.5Y, or neutral
Value—2 or 3
Chroma—0 or 1
Texture—silty clay or silty clay loam

Bg horizon:
Hue—10YR to 5Y or neutral
Value—3 to 5
Chroma—0 or 1
Texture—silty clay or silty clay loam

BCg horizon:
Hue—2.5Y, 5Y, or neutral
Value—4 or 5
Chroma—0 to 2
Texture—silty clay or silty clay loam

172—Wabash silty clay, 0 to 2 percent slopes

Composition

Wabash and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Silty alluvium
Frequency of flooding: Occasional

Water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 7.0 inches (moderate)
Organic matter content of the surface layer: About 4.5 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Chequest and similar soils

Major Uses of the Unit

- Cropland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Weller Series

Drainage class: Moderately well drained
Permeability: Slow
Landform: Uplands
Parent material: Loess
Native vegetation: Deciduous trees
Slope range: 2 to 14 percent

Typical Pedon

Weller silt loam, 2 to 5 percent slopes, 400 feet south and 620 feet east of the northwest corner of sec. 9, T. 72 N., R. 20 W.

Ap—0 to 7 inches; silt loam, 65 percent dark grayish brown (10YR 4/2) and 35 percent brown (10YR 5/3); light gray (10YR 7/2) dry; weak thin platy structure; friable; few prominent dark reddish brown (5YR 3/2) oxide coatings; moderately acid; abrupt smooth boundary.

E—7 to 12 inches; brown (10YR 5/3), grayish brown (10YR 5/2) exterior, yellowish brown (10YR 5/4) crushed silt loam; very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few grayish brown (10YR 5/2) discontinuous coatings and dark reddish brown (5YR 3/2) oxide coatings; very strongly acid; clear smooth boundary.

BE—12 to 18 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine subangular blocky structure parting to moderate fine angular blocky; firm; light gray (10YR 7/1) continuous coatings on faces of peds, clay films (cutans), and few very fine soft dark reddish brown (5YR 3/2) oxide coatings; very strongly acid; abrupt smooth boundary.

Bt1—18 to 25 inches; yellowish brown (10YR 5/4) silty clay; few fine distinct grayish brown (2.5Y 5/2) mottles; moderate very fine and fine subangular blocky structure parting to moderate very fine and fine angular blocky; very firm; very few prominent dark reddish brown (5YR 3/2) oxide coatings; very strongly acid; gradual smooth boundary.

Bt2—25 to 34 inches; yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) silty clay; few fine faint grayish brown (2.5Y 5/2) and distinct brown or dark brown (7.5YR 4/4) mottles; weak very fine subangular blocky structure; very firm; grayish brown (10YR 5/2) discontinuous organic coatings on faces of peds, continuous clay films (cutans), and few dark reddish brown (5YR 2/2) oxide coatings; very strongly acid; gradual smooth boundary.

Bt3—34 to 43 inches; grayish brown (2.5Y 5/2) silty clay; weak fine and medium subangular blocky structure; firm; continuous clay films (cutans) and few prominent dark reddish brown (5YR 2/2) oxide coatings; strongly acid; gradual smooth boundary.

Bt4—43 to 55 inches; yellowish brown (10YR 5/6) silty clay loam; few fine prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few faint brown (10YR 5/3) coatings on faces of peds, continuous clay films (cutans), very few light gray (10YR 7/2) discontinuous coatings on vertical faces of peds, and prominent reddish brown (5YR 4/4) oxide coatings; strongly acid; diffuse smooth boundary.

Bt5—55 to 60 inches; grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) silty clay loam; firm; discontinuous clay films (cutans) in root channels, pores, or both; moderately acid.

Range in Characteristics

Thickness of the solum: Greater than 48 inches

A horizon:
Hue—10YR
Value—3 or 4
Chroma—1 or 2
Texture—silt loam or silty clay loam

E horizon:
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—silt loam

Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 6
Texture—silty clay or silty clay loam

132B—Weller silt loam, 2 to 5 percent slopes

Composition

Weller and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves
Hillslope position: Shoulders and summits
Slope: 2 to 5 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

132C—Weller silt loam, 5 to 9 percent slopes

Composition

Weller and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches (high)
Organic matter content of the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

132C2—Weller silty clay loam, 5 to 9 percent slopes, moderately eroded

Composition

Weller and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches (high)
Organic matter content of the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

132D2—Weller silty clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Weller and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches (high)
Organic matter content of the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Zook Series

Drainage class: Poorly drained
Permeability: Slow
Landform: Flood plains and upland drainageways
Parent material: Silty alluvium
Native vegetation: Prairie grasses
Slope range: 0 to 5 percent

Typical Pedon

Zook silty clay loam, 0 to 2 percent slopes, 1,390 feet north and 1,030 feet west of the southeast corner of sec. 15, T. 72 N., R. 23 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; cloddy parting to moderate fine granular structure; friable; common medium and many very fine and fine roots; neutral; clear smooth boundary.

A1—7 to 14 inches; black (N 2/0) silty clay, very dark gray (10YR 3/1) dry; moderate very fine and fine granular structure; firm; common medium and many very fine and fine roots; neutral; clear smooth boundary.

A2—14 to 21 inches; black (N 2/0) silty clay, very dark gray (10YR 3/1) dry; moderate very fine and

fine subangular blocky structure; firm; few medium and many very fine and fine roots; few black (N 2/0) pressure faces on faces of peds; neutral; gradual smooth boundary.

A3—21 to 29 inches; black (N 2/0) silty clay, very dark gray (10YR 3/1) dry; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; few black (N 2/0) pressure faces on faces of peds; neutral; gradual smooth boundary.

A4—29 to 37 inches; silty clay, 50 percent black (N 2/0) and 50 percent black (10YR 2/1); very dark gray (10YR 3/1) dry; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; common very fine and fine roots; few black (10YR 2/1) pressure faces on faces of peds; few fine rounded iron-manganese concretions; neutral; clear smooth boundary.

Bg1—37 to 45 inches; silty clay, 50 percent black (10YR 2/1) and 50 percent very dark gray (10YR 3/1); few fine distinct brown or dark brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; common very fine and fine roots; few black (N 2/0) organic coatings and few black (10YR 2/1) pressure faces on faces of peds; few fine rounded iron-manganese concretions; neutral; clear smooth boundary.

Bg2—45 to 55 inches; silty clay, 50 percent very dark gray (10YR 3/1) and 50 percent dark gray (5Y 4/1); common fine distinct brown or dark brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine and fine roots; few black (10YR 2/1 and N 2/0) organic coatings on faces of peds; common fine rounded iron-manganese concretions; neutral; gradual smooth boundary.

BCg—55 to 60 inches; silty clay, 50 percent very dark gray (10YR 3/1) and 50 percent dark gray (5Y 4/1); common fine distinct brown or dark brown (7.5YR 4/4) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few very fine and fine roots; few black (10YR 2/1 and N 2/0) organic coatings on faces of peds; common fine rounded iron-manganese concretions; neutral.

Range in Characteristics

Thickness of the solum: 36 to 60 inches
Thickness of the mollic epipedon: 30 to 50 inches

A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam or silt loam

Bg horizon:
Hue—10YR to 5Y
Value—2 to 5
Chroma—1
Texture—silty clay or silty clay loam

BCg horizon:
Hue—10YR to 5Y
Value—2 to 5
Chroma—1
Texture—silty clay or silty clay loam

13B—Zook-Olmitz-Vesser complex, 0 to 5 percent slopes

Composition

Zook and similar soils: About 45 percent
Olmitz and similar soils: About 30 percent
Vesser and similar soils: About 20 percent
Inclusions: About 5 percent

Setting

Landform: Upland drainageways
Geomorphic component: Base slopes
Hillslope position: Toeslopes and footslopes
Slope: Zook—0 to 5 percent; Olmitz—2 to 5 percent; Vesser—2 to 5 percent

Component Description

Zook

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Local alluvium
Flooding: None
Water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 7.9 inches (moderate)
Organic matter content of the surface layer: About 6 percent (high)

Olmitz

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Local alluvium
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.7 inches (high)

Organic matter content of the surface layer: About 3.5 percent (moderate)

Vesser

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Local alluvium
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.0 inches (high)
Organic matter content of the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Nodaway and similar soils
- Ackmore and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

54—Zook silty clay loam, 0 to 2 percent slopes

Composition

Zook and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Silty alluvium
Frequency of flooding: Occasional
Water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 8.9 inches (moderate)
Organic matter content of the surface layer: About 6 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Chequest and similar soils
- Soils that have more sand than the Zook soil
- Soils that have a thinner surface layer than the Zook soil

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

54+—Zook silt loam, 0 to 2 percent slopes, overwash

Composition

Zook and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Silty alluvium
Frequency of flooding: Occasional
Water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 9.3 inches (high)
Organic matter content of the surface layer: About 3 percent (moderate)

A typical soil series description with range in

characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Chequest and similar soils
- Soils that have more sand throughout than the Zook soil

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

54B—Zook silty clay loam, 2 to 5 percent slopes

Composition

Zook and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Upland drainageways
Geomorphic component: Base slopes
Hillslope position: Toeslopes and footslopes
Slope: 2 to 5 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Silty alluvium
Flooding: None
Water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 7.9 inches (moderate)
Organic matter content of the surface layer: About 6 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have more sand than the Zook soil
- Soils that have a thinner surface layer than the Zook soil

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

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Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Backslope. The geomorphic component that forms the steepest inclined surface and principal element of many hillslopes (fig. 7). Backslopes in profile are commonly steep and linear and descend to a footslope. In terms of gradational process, backslopes are erosional forms produced mainly by mass wasting and running water.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope. A geomorphic component of hills. It consists of a concave surface at the bottom of hillslopes that is underlain by colluvial and slope-wash materials or forms a colluvial apron or wedge; a three-dimensional analog of a footslope. Distal base slope sediments commonly grade into, interfinger with, or are buried by alluvial fills.

Beach deposits. Material, such as sand and gravel, that is generally laid down parallel to an active or relict shoreline of a postglacial or glacial lake.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor

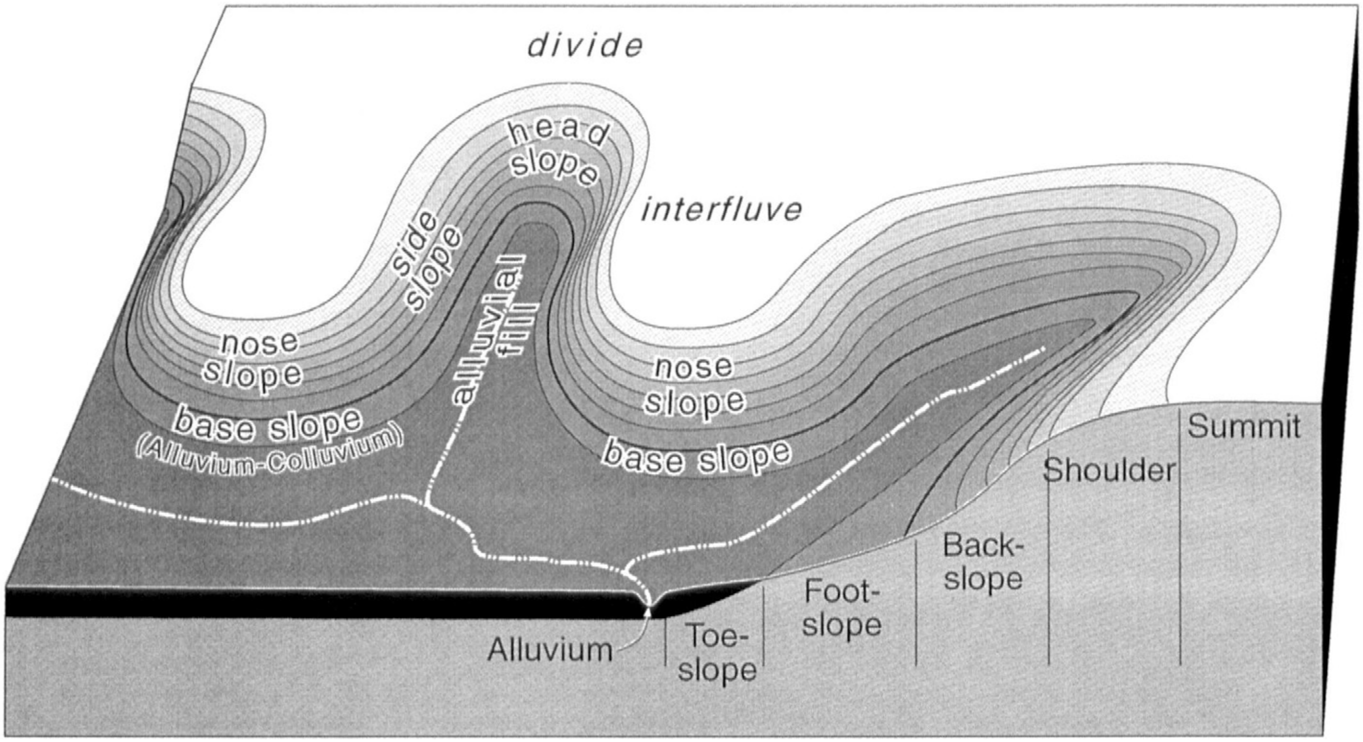

Figure 7.—Landscape relationship of geomorphic components and hillslope positions (modified after Ruhe and Walker, 1968).

formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. Any tillage and planting system in which a cover of crop residue is maintained on at least 30 percent of the surface after planting in order to reduce the hazard of water erosion; in areas where wind erosion is the primary concern, a system that maintains a cover of at least 1,000 pounds of flat residue of small grain or its equivalent during the critical erosion period.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour.

Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Delta. A body of alluvium having a surface that is nearly flat and fan shaped; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divide. (a) The line of separation, or (b) the summit area, or narrow tract of higher ground that constitutes the watershed boundary between two adjacent drainage basins; it divides the surface waters that flow naturally in one direction from those that flow in the opposite direction.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.

Well drained.—These soils have an intermediate or high water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of most field crops are affected. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted under natural conditions. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poor drainage is caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except for rice) under natural conditions.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Duff. A generally firm organic layer on the surface of

mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian deposits. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. The term is more often applied to cliffs resulting from differential erosion.

Esker. A long, narrow, sinuous, steep-sided ridge composed of irregularly stratified sand and gravel that were deposited by a subsurface stream flowing between ice walls or through ice tunnels of a retreating glacier and that were left behind when the ice melted. Eskers range from less than 1 mile to more than 100 miles in length and from 10 to 100 feet in height.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of fire fighters and equipment. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material is 35 to 60 percent flagstones, and extremely flaggy soil material is more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is generally a constructional landform consisting of sediment deposited during overflow and lateral migration of the stream.

Footslope. The geomorphic component that forms

the inner, gently inclined surface at the base of a hillslope. The surface is dominantly concave. In terms of gradational processes, a footslope is a transition zone between an upslope site of erosion (backslope) and a downslope site of deposition (toeslope).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Geomorphology. The science that treats the general configuration of the earth's surface; specifically the study of the classification, description, nature, origin, and development of landforms and their relationships to underlying structures, and the history of geologic changes as recorded by these surface features. The term is especially applied to the genetic interpretation of landforms.

Glacial drift. Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glaciofluvial deposits. Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Head slope. The concave surface at the head of a drainageway where the flow of water converges downward toward the center and contour lines form concave curves.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-chroma zones. Zones having chroma of 3 or more. Typical color in areas of iron concentrations.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 6 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Ice-walled lake plain. A relict surface marking the floor of an extinct lake basin that was formed on solid ground and surrounded by stagnant ice in a stable or unstable superglacial environment on stagnation moraines. As the ice melted the lake plain became perched above the adjacent landscape. The lake plain is well sorted, generally fine textured, stratified deposits.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not

a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Interfluve. A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways.

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Iron concentrations. High-chroma zones having a high content of iron and manganese oxide because of chemical oxidation and accumulation, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic concentration.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame. A moundlike hill of glacial drift, composed chiefly of stratified sand and gravel.

Kame moraine. An end moraine that contains numerous kames. A group of kames along the front of a stagnant glacier, commonly comprising the slumped remnants of a formerly continuous outwash plain built up over the foot of rapidly wasting or stagnant ice.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake bed. The bottom of a lake; a lake basin.

Lake plain. A nearly level surface marking the floor of an extinct lake filled by well sorted, generally fine textured, stratified deposits, commonly containing varves.

Lakeshore. A narrow strip of land in contact with or bordering a lake; especially the beach of a lake.

Lake terrace. A narrow shelf, partly cut and partly built, produced along a lakeshore in front of a scarp line of low cliffs and later exposed when the water level falls.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by the wind.

Low-chroma zones. Zones having chroma of 2 or less. Typical color in areas of iron depletions.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine. An accumulation of glacial drift in a topographic landform resulting chiefly from the direct action of glacial ice. Some types are lateral, recessional, and terminal.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

Nose slope. The projecting end of an interfluve, where contour lines connecting the opposing side slopes form convex curves around the projecting end and lines perpendicular to the contours diverge downward. Overland flow of water is divergent.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent

Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Outwash plain. An extensive area of glaciofluvial material that was deposited by meltwater streams.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Parts per million (ppm). The concentration of a substance in the soil, such as phosphorus or potassium, in one million parts of air-dried soil on a weight per weight basis.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment. A thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher lying areas of the erosion surface.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Extremely slow	less than 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

Phosphorus. The amount of phosphorus available to plants at a depth of 30 to 42 inches is expressed in parts per million and based on the weighted average of air-dried soil samples. Terms describing the amount of available phosphorus are:

Very low	less than 7.5 ppm
Low	7.5 to 13.0 ppm
Medium	13.0 to 22.5 ppm
High	more than 22.5 ppm

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitted outwash plain. An outwash plain marked by many irregular depressions, such as kettles, shallow pits, and potholes, which formed by melting of incorporated ice masses; many are found in Wisconsin and Minnesota.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plateau. An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Potassium. The amount of potassium available to plants at a depth of 12 to 24 inches is expressed in parts per million and based on the weighted average of air-dried soil samples. Terms describing the amount of available potassium are:

Very low	less than 50 ppm
Low	50 to 79 ppm
Medium	79 to 125 ppm
High	more than 125 ppm

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Burning an area under conditions of weather and soil moisture and at the time of day that will result in the intensity of heat and spread required to accomplish specific forest management, wildlife, grazing, or fire hazard reduction purposes.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	less than 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs the growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saprolite. Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder. The hillslope position that forms the uppermost inclined surface near the top of a hillslope. It comprises the transition zone from backslope to summit. The surface is dominantly convex in profile and erosional in orgin.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Side slope. The slope bounding a drainageway and lying between the drainageway and the adjacent interfluve. It is generally linear along the slope width, and overland flow is parallel down the slope.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Sloughed till. Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, on glacial outwash, or on a glaciolacustrine deposit.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stagnation moraine. A body of drift released by the melting of a glacier that ceased flowing. Commonly but not always occurs near ice margins; composed of till, ice-contact stratified drift, and small areas of glacial lake sediment. Typical landforms are knob-and-kettle topography, locally including ice-walled lake plains.

Stone line. A concentration of rock fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are: *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter or loosen a layer that restricts roots.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summit. The topographically highest position of a hillslope profile and exhibiting a nearly level surface. A general term for the top, or highest level, of a landform such as a hill, mountain, or tableland. It usually refers to a high interfluve area of gentler slope that is flanked by steeper hillslopes, for example, mountain fronts or tableland escarpments.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Swale. A slight depression in the midst of generally level land. A shallow depression in an undulating ground moraine due to uneven glacial deposition.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances. It commonly is a massive, arcuate ridge or complex of ridges underlain by till and other types of drift.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Till plain. An extensive area of nearly level to undulating or gently sloping soils that are underlain by till or consist of till. Slopes are 0 to 6 percent.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The outermost inclined surface at the base of a hill. Toeslopes are commonly gentle and linear in profile.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as salts, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The uprooting and tipping over of trees by the wind.

USDA United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with Iowa Agriculture and Home Economics Experiment Station; Cooperative Extension Service, Iowa State University; and Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship

Soil Survey of Lucas County, Iowa

Part II

How to Use This Soil Survey

This survey is divided into three parts. Part I includes general information about the survey area; descriptions of the general soil map units, detailed soil map units, and soil series in the area; and a description of how the soils formed. Part II describes the use and management of the soils and the major soil properties. This part may be updated as further information about soil management becomes available. Part III includes the maps.

On the **general soil map**, the survey area is divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** in Part I of this survey for a general description of the soils in your area.

The **detailed soil maps** can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**. Note the number of the map sheet, and turn to that sheet.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** in Part I of this survey, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** in Part II shows which table has data on a specific land use for each detailed soil map unit. See the **Contents** in Part I and Part II for other sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1990. Soil names and descriptions were approved in 1991. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1990. This survey was made cooperatively by the Natural Resources Conservation Service; the Iowa Agriculture and Home Economics Experiment Station; the Cooperative Extension Service, Iowa State University; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship. The survey is part of the technical assistance furnished to the Lucas County Soil and Water Conservation District. Funds appropriated by Lucas County were used to defray part of the cost of the survey.

Cover: A typical area of Gara and Pershing soils in Red Haw State Park.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service home page on the World Wide Web. The address is http://www.nrcs.usda.gov (click on "Technical Resources").

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5040—Orthents, loamy

Soil Survey of
Lucas County, Iowa

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Interpretive ratings help engineers, planners, and others understand how soil properties influence important nonagricultural uses, such as building site development and construction materials. The ratings indicate the most restrictive soil features affecting the suitability of the soils for these uses.

Soils are rated in their natural state. No unusual modification of the soil site or material is made other than that which is considered normal practice for the rated use. Even though soils may have limitations, it is important to remember that engineers and others can modify soil features or can design or adjust the plans for a structure to compensate for most of the limitations. Most of these practices, however, are costly. The final decision in selecting a site for a particular use generally involves weighing the costs of site preparation and maintenance.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The classification and extent of the soils in this survey area are shown in the tables "Classification of the Soils" and "Acreage and Proportionate Extent of the Soils," which are at the end of this section.

Classification of the Soils

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics that are outside the range of the series)

Soil name	Family or higher taxonomic class
Ackmore	Aeric Fluvaquents, fine-silty, mixed, nonacid, mesic
*Adair	Aquic Argiudolls, fine, montmorillonitic, mesic
Arispe	Aquic Argiudolls, fine, montmorillonitic, mesic
Armstrong	Aquollic Hapludalfs, fine, montmorillonitic, mesic
Bucknell	Udollic Ochraqualfs, fine, montmorillonitic, mesic, sloping
Caleb	Mollic Hapludalfs, fine-loamy, mixed, mesic
Chequest	Typic Haplaquolls, fine, montmorillonitic, mesic
Clarinda	Typic Argiaquolls, fine, montmorillonitic, mesic, sloping
Edina	Typic Argialbolls, fine, montmorillonitic, mesic
Gara	Mollic Hapludalfs, fine-loamy, mixed, mesic
Gosport	Typic Dystrochrepts, fine, illitic, mesic
Grundy	Aquertic Argiudolls, fine, montmorillonitic, mesic
Haig	Typic Argiaquolls, fine, montmorillonitic, mesic
Humeston	Argiaquic Argialbolls, fine, montmorillonitic, mesic
Keswick	Aquic Hapludalfs, fine, montmorillonitic, mesic
Lamoni	Aquic Argiudolls, fine, montmorillonitic, mesic
Lawson	Cumulic Hapludolls, fine-silty, mixed, mesic
Lindley	Typic Hapludalfs, fine-loamy, mixed, mesic
Lineville	Aquollic Hapludalfs, fine-loamy, mixed, mesic
Mystic	Aquollic Hapludalfs, fine, montmorillonitic, mesic
Nodaway	Mollic Udifluvents, fine-silty, mixed, nonacid, mesic
Olmitz	Cumulic Hapludolls, fine-loamy, mixed, mesic
Pershing	Aquollic Hapludalfs, fine, montmorillonitic, mesic
Rinda	Mollic Ochraqualfs, fine, montmorillonitic, mesic, sloping
Shelby	Typic Argiudolls, fine-loamy, mixed, mesic
Tuskeego	Mollic Ochraqualfs, fine, montmorillonitic, mesic
Vesser	Argiaquic Argialbolls, fine-silty, mixed, mesic
Wabash	Vertic Haplaquolls, fine, montmorillonitic, mesic
Weller	Aquic Hapludalfs, fine, montmorillonitic, mesic
Zook	Cumulic Haplaquolls, fine, montmorillonitic, mesic

Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
13B	Zook-Olmitz-Vesser complex, 0 to 5 percent slopes	21,800	7.8
23C	Arispe silty clay loam, 5 to 9 percent slopes	3,975	1.4
23C2	Arispe silty clay loam, 5 to 9 percent slopes, moderately eroded	21,925	7.9
24D	Shelby clay loam, 9 to 14 percent slopes	210	*
24D2	Shelby clay loam, 9 to 14 percent slopes, moderately eroded	3,075	1.1
24E2	Shelby clay loam, 14 to 18 percent slopes, moderately eroded	4,340	1.6
24E3	Shelby clay loam, 14 to 18 percent slopes, severely eroded	285	0.1
24F2	Shelby clay loam, 18 to 25 percent slopes, moderately eroded	915	0.3
51	Vesser silt loam, 0 to 2 percent slopes	930	0.3
51+	Vesser silt loam, 0 to 2 percent slopes, overwash	355	0.1
51B	Vesser silt loam, 2 to 5 percent slopes	935	0.3
51B+	Vesser silt loam, 2 to 5 percent slopes, overwash	445	0.2
54	Zook silty clay loam, 0 to 2 percent slopes	2,595	0.9
54+	Zook silt loam, 0 to 2 percent slopes, overwash	1,320	0.5
54B	Zook silty clay loam, 2 to 5 percent slopes	790	0.3
65E	Lindley loam, 14 to 18 percent slopes	205	*
65E2	Lindley loam, 14 to 18 percent slopes, moderately eroded	425	0.2
65F	Lindley loam, 18 to 25 percent slopes	2,715	1.0
65F2	Lindley loam, 18 to 25 percent slopes, moderately eroded	4,645	1.7
65G	Lindley loam, 25 to 40 percent slopes	2,390	0.9
65G2	Lindley loam, 25 to 40 percent slopes, moderately eroded	3,345	1.2
93D2	Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded	1,470	0.5
94D2	Mystic-Caleb complex, 9 to 14 percent slopes, moderately eroded	2,145	0.8
94E2	Mystic-Caleb complex, 14 to 18 percent slopes, moderately eroded	1,035	0.4
131B	Pershing silt loam, 2 to 5 percent slopes	1,925	0.7
131C	Pershing silt loam, 5 to 9 percent slopes	6,935	2.5
131C2	Pershing silty clay loam, 5 to 9 percent slopes, moderately eroded	11,200	4.0
131D2	Pershing silty clay loam, 9 to 14 percent slopes, moderately eroded	520	0.2
132B	Weller silt loam, 2 to 5 percent slopes	230	*
132C	Weller silt loam, 5 to 9 percent slopes	1,245	0.4
132C2	Weller silty clay loam, 5 to 9 percent slopes, moderately eroded	1,585	0.6
132D2	Weller silty clay loam, 9 to 14 percent slopes, moderately eroded	305	0.1
172	Wabash silty clay, 0 to 2 percent slopes	455	0.2
179D2	Gara clay loam, 9 to 14 percent slopes, moderately eroded	1,680	0.6
179E	Gara loam, 14 to 18 percent slopes	870	0.3
179E2	Gara clay loam, 14 to 18 percent slopes, moderately eroded	14,985	5.4
179E3	Gara clay loam, 14 to 18 percent slopes, severely eroded	205	*
179F	Gara loam, 18 to 25 percent slopes	2,355	0.8
179F2	Gara clay loam, 18 to 25 percent slopes, moderately eroded	15,400	5.5
179G2	Gara clay loam, 25 to 40 percent slopes, moderately eroded	710	0.3
192C2	Adair clay loam, 5 to 9 percent slopes, moderately eroded	3,125	1.1
192D2	Adair clay loam, 9 to 14 percent slopes, moderately eroded	1,730	0.6
211	Edina silt loam, depressional, 0 to 1 percent slopes	2,160	0.8
220	Nodaway silt loam, 0 to 2 percent slopes	6,440	2.3
222C	Clarinda silty clay loam, 5 to 9 percent slopes	695	0.2
222C2	Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded	7,660	2.8
222C3	Clarinda silty clay loam, 5 to 9 percent slopes, severely eroded	765	0.3
222D2	Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded	785	0.3
223C2	Rinda silty clay loam, 5 to 9 percent slopes, moderately eroded	460	0.2
223D2	Rinda silty clay loam, 9 to 14 percent slopes, moderately eroded	430	0.2
269	Humeston silty clay loam, 0 to 2 percent slopes	1,135	0.4
269+	Humeston silt loam, 0 to 2 percent slopes, overwash	355	0.1
273B	Olmitz loam, 2 to 5 percent slopes	700	0.3
273C	Olmitz loam, 5 to 9 percent slopes	565	0.2
313D2	Gosport silty clay loam, 9 to 14 percent slopes, moderately eroded	395	0.1
313E2	Gosport silty clay loam, 14 to 18 percent slopes, moderately eroded	935	0.3
313F	Gosport silt loam, 18 to 25 percent slopes	225	*
313F2	Gosport silty clay loam, 18 to 25 percent slopes, moderately eroded	1,225	0.4
362	Haig silt loam, 0 to 2 percent slopes	13,675	4.9
364B	Grundy silty clay loam, 2 to 5 percent slopes	20,435	7.3

See footnote at end of table.

Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
423C2	Bucknell silty clay loam, 5 to 9 percent slopes, moderately eroded	1,220	0.4
423D	Bucknell silty clay loam, 9 to 14 percent slopes	305	0.1
423D2	Bucknell silty clay loam, 9 to 14 percent slopes, moderately eroded	6,800	2.4
425D	Keswick loam, 9 to 14 percent slopes	2,180	0.8
425D2	Keswick clay loam, 9 to 14 percent slopes, moderately eroded	4,085	1.5
430	Ackmore silt loam, 0 to 2 percent slopes	1,195	0.4
451D2	Caleb loam, 9 to 14 percent slopes, moderately eroded	245	*
451E2	Caleb loam, 14 to 18 percent slopes, moderately eroded	420	0.2
452C	Lineville silt loam, 5 to 9 percent slopes	535	0.2
452C2	Lineville silt loam, 5 to 9 percent slopes, moderately eroded	250	*
453	Tuskeego silt loam, 0 to 2 percent slopes	310	0.1
470D2	Lamoni-Shelby complex, 9 to 14 percent slopes, moderately eroded	2,990	1.1
484	Lawson silt loam, 0 to 2 percent slopes	470	0.2
587	Chequest silty clay loam, 0 to 2 percent slopes	555	0.2
587+	Chequest silt loam, 0 to 2 percent slopes, overwash	280	0.1
592C2	Mystic clay loam, 5 to 9 percent slopes, moderately eroded	1,385	0.5
592D2	Mystic clay loam, 9 to 14 percent slopes, moderately eroded	2,165	0.8
711	Nodaway-Lawson complex, 0 to 2 percent slopes	3,125	1.1
792C	Armstrong loam, 5 to 9 percent slopes	400	0.1
792C2	Armstrong clay loam, 5 to 9 percent slopes, moderately eroded	2,630	0.9
792D	Armstrong loam, 9 to 14 percent slopes	1,575	0.6
792D2	Armstrong clay loam, 9 to 14 percent slopes, moderately eroded	18,500	6.6
792D3	Armstrong clay loam, 9 to 14 percent slopes, severely eroded	215	*
822C	Lamoni silty clay loam, 5 to 9 percent slopes	420	0.2
822C2	Lamoni silty clay loam, 5 to 9 percent slopes, moderately eroded	4,605	1.7
822D	Lamoni silty clay loam, 9 to 14 percent slopes	200	*
822D2	Lamoni silty clay loam, 9 to 14 percent slopes, moderately eroded	3,905	1.4
831B	Pershing silt loam, bench, 2 to 5 percent slopes	825	0.3
831C	Pershing silt loam, bench, 5 to 9 percent slopes	855	0.3
831C2	Pershing silty clay loam, bench, 5 to 9 percent slopes, moderately eroded	1,205	0.4
894D2	Bucknell-Gara complex, 9 to 14 percent slopes, moderately eroded	395	0.1
993D2	Gara-Armstrong complex, 9 to 14 percent slopes, moderately eroded	2,140	0.8
1711	Nodaway-Lawson complex, channeled, 0 to 2 percent slopes	3,260	1.2
5021	Orthents, hilly	100	*
5025	Strip mines, dumps	120	*
5040	Orthents, loamy	165	*
	Total	278,300	100.0

* Less than 0.1 percent.

Agronomy

General management needed for crops and for hay and pasture is suggested in this section. The system of land capability classification used by the Natural Resources Conservation Service is explained, and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider obtaining specific information from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Cropland Management Considerations

The management concerns affecting the use of the detailed soil map units in the survey area for crops are shown in the table "Cropland Management Considerations." The main concerns in managing nonirrigated cropland are conserving moisture, controlling wind erosion and water erosion, and maintaining soil fertility.

Conserving moisture consists primarily of reducing the evaporation and runoff rates and increasing the water intake rate. Applying conservation tillage and conservation cropping systems, farming on the contour, stripcropping, establishing field windbreaks, and leaving crop residue on the surface conserve moisture.

Generally, a combination of several practices is needed to control *wind erosion* and *water erosion*. Conservation tillage, stripcropping, field windbreaks, contour farming, conservation cropping systems, crop residue management, terraces, diversions, and grassed waterways help to prevent excessive soil loss (fig. 1).

Measures that are effective in maintaining *soil fertility* include applying fertilizer, both organic and inorganic, including manure; incorporating crop residue or green manure crops into the soil; and using proper crop rotations. Controlling erosion helps to prevent the loss of organic matter and plant nutrients and thus helps to maintain productivity, although the level of fertility can be reduced even in areas where erosion is controlled. All soils used for nonirrigated crops respond well to applications of fertilizer.

Some of the considerations shown in the table cannot be easily overcome. These are *channels, flooding, gullies,* and *ponding*.

Additional considerations are as follows:

Lime content, limited available water capacity, potential poor tilth and compaction, and *restricted permeability*.—These limitations can be minimized by incorporating green manure crops, manure, or crop residue into the soil; applying a system of conservation tillage; and using conservation cropping systems. Also, crops may respond well to additions of phosphate fertilizer to soils that have a high content of lime.

Potential for ground-water contamination.—The proper use of nutrients and pesticides can reduce the risk of ground-water contamination.

Potential for surface-water contamination.—The risk of surface-water contamination can be reduced by the proper use of nutrients and pesticides and by conservation farming practices that reduce the runoff rate.

Surface crusting.—This limitation retards seedling development after periods of heavy rainfall.

Surface rock fragments.—This limitation causes rapid wear of tillage equipment. It cannot be easily overcome.

Surface stones.—Stones or boulders on or near the surface can hinder normal tillage unless they are removed.

Salt content.—In areas where this is a limitation, only salt-tolerant crops should be grown.

On irrigated soils the main management concerns are *efficient water use, nutrient management, control of erosion, pest and weed control,* and *timely planting and harvesting* for a successful crop. An irrigation system that provides optimum control and distribution of water at minimum cost is needed. Overirrigation wastes water, leaches plant nutrients, and causes erosion. Also, it can create drainage

Figure 1.—Contour terraces in an area of Grundy silty clay loam, 2 to 5 percent slopes.

problems, raise the water table, and increase soil salinity.

Explanation of Criteria

Acid soil.—The pH is less than 6.1.

Channeled.—The word "channeled" is included in the map unit name.

Dense layer.—The bulk density is 1.80 g/cc or greater within the soil profile.

Depth to rock.—The depth to bedrock is less than 40 inches.

Eroded.—The word "eroded" is included in the map unit name.

Excessive permeability.—Permeability is 6 inches per hour or more within the soil profile.

Flooding.—Flooding is occasional or frequent.

Gullied.—The word "gullied" is included in the map unit name.

High organic matter content.—The surface layer has more than 20 percent organic matter.

Lime content.—The pH is 7.4 or more in the surface layer, or the wind erodibility group is 4L.

Limited available water capacity.—The available water capacity calculated to a depth of 60 inches or to a root-limiting layer is 6 inches or less.

Limited organic matter content.—The content of

organic matter is 2 percent or less in the surface layer.

Ponding.—Ponding duration is assigned to the map unit component. The water table is above the surface.

Potential poor tilth and compaction.—The content of clay is 27 percent or more in the surface layer.

Potential for ground-water contamination (by nutrients or pesticides).—Depth to the water table is 4 feet or less, the permeability of any layer is more than 6.0 inches per hour, or the depth to bedrock is less than 60 inches.

Potential for surface-water contamination (by nutrients or pesticides).—The map unit component is occasionally flooded or frequently flooded, is subject to ponding, is assigned to hydrologic group C or D and has a slope of more than 2 percent, is assigned to hydrologic group A and has a slope of more than 6 percent, or is assigned to hydrologic group B, has a slope of 3 percent or more, and has a K factor of more than 0.17.

Restricted permeability.—Permeability is less than 0.06 inch per hour within the soil profile.

Salt content.—The electrical conductivity is 4 or more in the surface layer or 8 or more within a depth of 30 inches.

Slope (equipment limitation).—The slope is more than 15 percent.

Surface crusting.—The content of clay is 27 percent or more and the content of organic matter is 2 percent or less in the surface layer.

Surface rock fragments (equipment limitation).—The terms describing the texture of the surface layer include any rock fragment modifier, except for gravelly, channery, stony, very stony, extremely stony, bouldery, very bouldery, and extremely bouldery.

Surface stones (equipment limitation).—The word "stony" or "bouldery" is included in the map unit name or in the description of the surface layer.

Water erosion.—Either the slope is 6 percent or more, or the slope is more than 3 percent and less than 6 percent and the surface layer is not sandy.

Water table.—A water table is within 2.5 feet of the surface.

Wind erosion.—The wind erodibility group is 1, 2, 3, or 4L.

Agronomic Considerations

Inherent subsoil fertility levels, in terms of potential plant-available phosphorus and potassium, are described in the table "Agronomic Considerations" at the end of this section. Soil tests of the tilled layer are used to determine the most profitable rates of fertilizers for various crops. Nutrient levels in the subsurface layers do influence crop yields, particularly in the drier seasons when the nutrients in the dry tilled layer become temporarily unavailable to plants. The availability of nutrients in the tilled layer and the subsoil influences the relative uptake from the two zones in the soil profile. Fertilizer recommendations based on soil tests of the tilled layer may be adjusted by the average nutrient levels in the subsoil of each soil series. Fertilizer recommendations are adjusted for subsoil nutrient levels. The ratings given in the table are described as follows:

Subsoil phosphorus.—The amount of plant-available phosphorus in the subsoil expressed in parts per million and based on the weighted average of air-dried soil samples from the subsoil (at a depth of 30 to 42 inches). (The value listed for complexes is the most limiting value of the soils identified in the map unit name.) A rating of *very low* indicates less than 7.5 ppm; *low,* 7.5 to 13.0 ppm; *medium,* 13.0 to 22.5 ppm; and *high,* more than 22.5 ppm.

Subsoil potassium.—The amount of plant-available potassium in the subsoil expressed in parts per million and based on the weighted average of air-dried soil samples from the subsoil (at a depth of 12 to 24 inches). (The value listed for complexes is the most limiting value of the soils identified in the map unit name.) A rating of *very low minus* indicates less than 25 ppm; *very low plus,* 25 to 50 ppm; *low,* 50 to 79 ppm; *medium,* 79 to 125 ppm; and *high,* more than 125 ppm.

Tilth rating.—This rating is based on clay content, organic matter content, drainage class, sand size, and sand content. A rating of 1 indicates good tilth; 2, fair; 3, poor; and 4, very poor.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland or for engineering purposes.

In the capability system, soils generally are grouped at three levels—capability class, subclass, and unit (USDA, 1961). These categories indicate the degree and kinds of limitations affecting mechanized farming systems that produce the more commonly grown field crops, such as corn, small grain, cotton, hay, and field-grown vegetables. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by numerals 1 through 8. The numerals indicate progressively greater limitations and narrower choices for practical use.

If properly managed, soils in classes 1, 2, 3, and 4 are suitable for the mechanized production of commonly grown field crops and for pasture and woodland. The degree of the soil limitations affecting the production of cultivated crops increases progressively from class 1 to class 4. The limitations can affect levels of production and the risk of permanent soil deterioration caused by erosion and other factors.

Soils in classes 5, 6, and 7 are generally not suited to the mechanized production of commonly grown field crops without special management, but they are suitable for plants that provide a permanent cover, such as grasses and trees. The severity of the soil limitations affecting crops increases progressively from class 5 to class 7.

Areas in class 8 are generally not suitable for crops, pasture, or woodland without a level of management that is impractical. These areas may have potential for other uses, such as recreational facilities and wildlife habitat.

Capability subclasses identify the dominant kind of limitation in the class. They are designated by adding a small letter, *e, w, s,* or *c*, to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the risk of erosion unless a close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

There are no subclasses in class 1 because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w, s,* or *c* because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use mainly to pasture, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the tables "Land Capability, Corn Suitability Rating, and Yields per Acre of Crops" and "Land Capability and Yields per Acre of Crops and Pasture" at the end of this section.

Corn Suitability Rating (CSR)

The corn suitability rating for the soils in the survey area is given in the table "Land Capability, Corn Suitability Rating, and Yields per Acre of Crops." Corn suitability ratings provide a relative ranking of all soils mapped in the State of Iowa based on their potential to be utilized for the intensive production of row crops. The CSR is an index that can be used to rate the potential production of one soil compared with another over a period of time. The CSR considers average weather conditions and frequency of use of the soil for row crops. Ratings range from 100 for soils that have no physical limitations, are on minimal slopes, and can be continuously row cropped to as low as 5 for soils that have severe limitations affecting the production of row crops. The ratings listed in this table assume adequate management, natural weather conditions (no irrigation), artificial drainage where required, and no land leveling or terracing. They also assume that soils in the lower positions on the landscape are not affected by frequent damaging floods. The weighted CSR for a given field can be modified by the occurrence of sandy spots, local deposits, rock and gravel outcrops, field boundaries, and noncrossable drainageways. Even though predicted average yields will change with time, the CSR's are expected to remain relatively constant in relation to one another.

The CSR's in Lucas County range from 90 for Lawson silt loam, 0 to 2 percent slopes, to 5 for several map units, including Lindley loam, 25 to 40 percent slopes, moderately eroded. No ratings are provided for miscellaneous areas because of the variability of properties and use of these areas.

Crop Yield Estimates

The average yields per acre that can be expected of the principal crops under a high level of management are shown in the tables "Land Capability, Corn Suitability Rating, and Yields per Acre of Crops" and "Land Capability and Yields per Acre of Crops and Pasture." In any given year, yields may be higher or lower than those indicated in the tables because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the tables.

The yields are based mainly on the experience and

records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in the tables are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Pasture and Hayland Interpretations

Under good management, proper grazing is essential for the production of high-quality forage, stand survival, and erosion control. Proper grazing helps plants to maintain sufficient and generally vigorous top growth during the growing season. Brush control is essential in many areas, and weed control generally is needed. Rotation grazing and renovation also are important management practices.

Yield estimates are often provided in animal unit months (AUM), or the amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about forage yields other than those shown in the tables.

Prime Farmland

Prime farmland is of major importance in meeting the Nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, State, and Federal levels, as well as individuals, must encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to food, feed, forage, fiber, and oilseed crops. Such soils have properties that favor the economic production of sustained high yields of crops. The soils need only to be treated and managed by acceptable farming methods. An adequate moisture supply and a sufficiently long growing season are required. Prime farmland soils produce the highest yields with minimal expenditure of energy and economic resources, and farming these soils results in the least damage to the environment (fig. 2).

Prime farmland soils may presently be used as cropland, pasture, or woodland or for other purposes. They either are used for food and fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water-control structures. Public land is land not available for farming in National forests, National parks, military reservations, and State parks.

Prime farmland soils commonly receive an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable, and the level of acidity or alkalinity and the content of salts and sodium are acceptable. The soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods, and they are not frequently flooded during the growing season or are protected from flooding. Slopes range mainly from 0 to 6 percent.

Soils that have a high water table or are subject to flooding may qualify as prime farmland where these limitations are overcome by drainage measures or flood control. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information about the criteria for prime farmland can be obtained at the local office of the Natural Resources Conservation Service.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses. The

Figure 2.—An area of Zook-Olmitz-Vesser complex, 0 to 5 percent slopes. These soils qualify as prime farmland.

loss of prime farmland to other uses puts pressure on lands that are less productive than prime farmland.

About 86,000 acres, or nearly 31 percent of the survey area, meets the requirements for prime farmland.

The map units in the survey area that meet the requirements for prime farmland are listed in the table "Prime Farmland." This list does not constitute a recommendation for a particular land use. On some soils included in the table, measures that overcome limitations are needed. The need for these measures is indicated in parentheses after the map unit name. The location of each map unit is shown on the detailed soil maps. The soil qualities that affect use and management are described in the section "Soil Series and Detailed Soil Map Units" in Part I of this survey.

Erosion Factors

Soil erodibility (K) and soil-loss tolerance (T) factors are used in an equation that predicts the amount of soil lost through water erosion in areas of cropland. The procedure for predicting soil loss is useful in guiding the selection of soil and water conservation practices. The erosion factors for the soils in the survey area are listed in the table "Physical Properties of the Soils."

Soil Erodibility (K) Factor

The soil erodibility (K) factor indicates the susceptibility of a soil to sheet and rill erosion by water. The soil properties that influence erodibility are those that affect the infiltration rate, the movement of water through the soil, and the water storage capacity of the soil and those that allow the soil to resist dispersion, splashing, abrasion, and the transporting forces of rainfall and runoff. The most important soil properties are the content of silt plus very fine sand, the content of sand coarser than very fine sand, the content of organic matter, soil structure, and permeability.

Fragment-Free Soil Erodibility (Kf) Factor

This is one of the factors used in the revised Universal Soil Loss Equation. It shows the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Soil-Loss Tolerance (T) Factor

The soil-loss tolerance (T) factor is an estimate of the maximum annual rate of soil erosion that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons of soil loss per acre per year. Ratings of 1 to 5 are used, depending on soil properties and prior erosion. The criteria used in assigning a T factor to a soil include maintenance of an adequate rooting depth for crop production, potential reduction of crop yields, maintenance of water-control structures affected by sedimentation, prevention of gullying, and the value of nutrients lost through erosion.

Wind Erodibility Groups

Wind erodibility is directly related to the percentage of dry, nonerodible surface soil aggregates larger than 0.84 millimeter in diameter. From this percentage, the wind erodibility index (I) factor is determined. This factor is an expression of the stability of the soil aggregates, or the extent to which they are broken down by tillage and the abrasion caused by windblown soil particles. Soils are assigned to wind erodibility groups (WEG) having similar percentages of dry soil aggregates larger than 0.84 millimeter. The wind erodibility groups and wind erodibility index numbers are listed in the table "Physical Properties of the Soils."

Additional information about wind erodibility groups and K, Kf, T, and I factors can be obtained from local offices of the Natural Resources Conservation Service or the Cooperative Extension Service.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection (fig. 3).

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Windbreaks are often planted on land that did not originally support trees. Knowledge of how trees perform on such land can be gained only by observing and recording the performance of trees that have been planted and have survived. Many popular windbreak species are not indigenous to the areas in which they are planted.

Each tree or shrub species has certain climatic and physiographic limits. Within these parameters, a tree or shrub may grow well or grow poorly, depending on the characteristics of the soil. Each tree or shrub has definable potential heights in a given physiographic area and under a given climate. Accurate definitions of potential heights are necessary when a windbreak is planned and designed.

The table "Windbreaks and Environmental Plantings" shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in this table are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Natural Resources Conservation Service or the Cooperative Extension Service or from a nursery.

Figure 3.—A windbreak in an area of Arispe silty clay loam, 5 to 9 percent slopes.

Windbreak Suitability Groups

Windbreak suitability groups consist of soils in which the kinds and degrees of the hazards and limitations that affect the survival and growth of trees and shrubs in windbreaks are about the same. The windbreak suitability group for each soil in the survey area is listed in the table "Windbreak Suitability Groups" at the end of this section. The following paragraphs explain the characteristics of the soils in each group.

Group 1 consists of soils that are somewhat poorly drained or moderately well drained, are rapidly permeable to moderately slowly permeable, and do not have free carbonates in the upper 20 inches.

Group 1K consists of soils that are somewhat poorly drained or moderately well drained, are rapidly permeable to moderately slowly permeable, and have free carbonates within 20 inches of the surface. These soils may be very slightly saline or slightly saline (the electrical conductivity is 2 to 8).

Group 2 consists of poorly drained soils that have been artificially drained and do not have free carbonates in the upper 20 inches. Permeability varies.

Group 2K consists of poorly drained or very poorly drained soils that have been artificially drained and have free carbonates within 20 inches of the surface. Permeability varies. These soils may be very slightly saline or slightly saline (the electrical conductivity is 2 to 8).

Group 2H consists of very poorly drained soils that have been artificially drained and have more than 16 inches of organic material. Permeability varies.

Group 2W consists of very poorly drained soils that are subject to ponding and have been artificially drained. It includes soils that have an organic surface layer up to 16 inches thick. Permeability varies.

Group 3 consists of soils that are well drained or moderately well drained and are loamy or silty throughout. Permeability is moderate or moderately slow. These soils do not have free carbonates in the upper 20 inches.

Group 4 consists of soils that are well drained, moderately well drained, or somewhat poorly drained

and have a silty or loamy surface layer and a clayey subsoil. Permeability is slow or very slow.

Group 4C consists of soils that are well drained, moderately well drained, or somewhat poorly drained and have a clayey surface layer and subsoil. Permeability is slow or very slow.

Group 4F consists of soils that are well drained, moderately well drained, or somewhat poorly drained and have a substratum of dense till. Permeability is slow or very slow.

Group 5 consists of soils that are excessively drained to moderately well drained and have a moderate available water capacity. These soils are dominantly fine sandy loam or sandy loam, but some are sandy in the upper part and loamy in the lower part.

Group 6G consists of excessively drained to moderately well drained soils that are loamy in the upper part and have sand or sand and gravel at a depth of 20 to 40 inches. These soils have a low or moderate available water capacity.

Group 6D consists of excessively drained to moderately well drained, loamy soils that have bedrock at a depth of 20 to 40 inches. These soils have a low or moderate available water capacity.

Group 7 consists of excessively drained to well drained soils that are dominantly loamy fine sand or coarser textured and are shallow to sand or to sand and gravel. These soils have a low available water capacity.

Group 8 consists of excessively drained to well drained, loamy soils that have free carbonates within 20 inches of the surface.

Group 9W consists of soils that are somewhat poorly drained, poorly drained, or very poorly drained and are moderately saline (the electrical conductivity is 8 to 16).

Group 10 consists of soils or miscellaneous land types that generally are not suitable for windbreaks. One or more characteristics, such as soil depth, texture, wetness, available water capacity, or slope, limit the planting, survival, or growth of trees and shrubs.

Cropland Management Considerations

(See text for a description of the considerations listed in this table)

Map symbol and soil name	Cropland management considerations
13B:	
Zook	Potential for ground-water contamination Potential poor tilth and compaction Water erosion Water table
Olmitz	Potential for surface-water contamination Water erosion
Vesser	Acid soil Potential for ground-water contamination Potential for surface-water contamination Water erosion Water table
23C:	
Arispe	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water erosion Water table
23C2:	
Arispe	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion Water table
24D:	
Shelby	Potential for surface-water contamination Potential poor tilth and compaction Water erosion
24D2:	
Shelby	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion
24E2, 24E3, 24F2:	
Shelby	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Slope Water erosion
51, 51+:	
Vesser	Acid soil Flooding Potential for ground-water contamination Potential for surface-water contamination Water table
51B, 51B+:	
Vesser	Acid soil Potential for ground-water contamination Potential for surface-water contamination Water erosion Water table

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
54:	
Zook	Flooding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
54+:	
Zook	Flooding Potential for ground-water contamination Potential for surface-water contamination Water table
54B:	
Zook	Potential for ground-water contamination Potential poor tilth and compaction Water erosion Water table
65E:	
Lindley	Potential for surface-water contamination Slope Water erosion
65E2:	
Lindley	Potential for surface-water contamination Previously eroded Slope Water erosion
65F:	
Lindley	Potential for surface-water contamination Slope Water erosion
65F2:	
Lindley	Potential for surface-water contamination Previously eroded Slope Water erosion
65G:	
Lindley	Potential for surface-water contamination Slope Water erosion
65G2:	
Lindley	Potential for surface-water contamination Previously eroded Slope Water erosion
93D2:	
Shelby	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion
Adair	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion Water table

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
94D2:	
Mystic	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion Water table
Caleb	Acid soil Potential for ground-water contamination Potential for surface-water contamination Previously eroded Water erosion
94E2:	
Mystic	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Slope Water erosion Water table
Caleb	Acid soil Potential for ground-water contamination Potential for surface-water contamination Previously eroded Slope Water erosion
131B, 131C:	
Pershing	Acid soil Potential for ground-water contamination Potential for surface-water contamination Water erosion Water table
131C2, 131D2:	
Pershing	Acid soil Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion Water table
132B, 132C:	
Weller	Acid soil Potential for ground-water contamination Potential for surface-water contamination Water erosion Water table
132C2, 132D2:	
Weller	Acid soil Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion Water table

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
172:	
Wabash	Flooding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Restricted permeability Water table
179D2:	
Gara	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion
179E:	
Gara	Potential for surface-water contamination Slope Water erosion
179E2:	
Gara	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Slope Water erosion
179E3:	
Gara	Limited organic matter content Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Slope Surface crusting Water erosion
179F:	
Gara	Potential for surface-water contamination Slope Water erosion
179F2:	
Gara	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Slope Water erosion
179G2:	
Gara	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Slope Water erosion
192C2, 192D2:	
Adair	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion Water table

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
211:	
Edina	Potential for ground-water contamination
	Restricted permeability
	Water table
220:	
Nodaway	Flooding
	Potential for ground-water contamination
	Potential for surface-water contamination
222C:	
Clarinda	Potential for ground-water contamination
	Potential for surface-water contamination
	Potential poor tilth and compaction
	Restricted permeability
	Water erosion
	Water table
222C2, 222C3, 222D2:	
Clarinda	Potential for ground-water contamination
	Potential for surface-water contamination
	Potential poor tilth and compaction
	Previously eroded
	Restricted permeability
	Water erosion
	Water table
223C2, 223D2:	
Rinda	Potential for ground-water contamination
	Potential for surface-water contamination
	Potential poor tilth and compaction
	Previously eroded
	Restricted permeability
	Water erosion
	Water table
269:	
Humeston	Acid soil
	Flooding
	Potential for ground-water contamination
	Potential for surface-water contamination
	Potential poor tilth and compaction
	Restricted permeability
	Water table
269+:	
Humeston	Acid soil
	Flooding
	Limited organic matter content
	Potential for ground-water contamination
	Potential for surface-water contamination
	Restricted permeability
	Water table
273B, 273C:	
Olmitz	Potential for surface-water contamination
	Water erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
313D2:	
Gosport	Acid soil Depth to rock Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Restricted permeability Water erosion Water table
313E2:	
Gosport	Acid soil Depth to rock Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Restricted permeability Slope Water erosion Water table
313F:	
Gosport	Acid soil Depth to rock Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Restricted permeability Slope Water erosion Water table
313F2:	
Gosport	Acid soil Depth to rock Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Restricted permeability Slope Water erosion Water table
362:	
Haig	Acid soil Potential for ground-water contamination Restricted permeability Water table
364B:	
Grundy	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water erosion Water table

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
423C2:	
Bucknell	Acid soil
	Potential for ground-water contamination
	Potential for surface-water contamination
	Potential poor tilth and compaction
	Previously eroded
	Restricted permeability
	Water erosion
	Water table
423D:	
Bucknell	Acid soil
	Potential for ground-water contamination
	Potential for surface-water contamination
	Potential poor tilth and compaction
	Restricted permeability
	Water erosion
	Water table
423D2:	
Bucknell	Acid soil
	Potential for ground-water contamination
	Potential for surface-water contamination
	Potential poor tilth and compaction
	Previously eroded
	Restricted permeability
	Water erosion
	Water table
425D:	
Keswick	Acid soil
	Potential for ground-water contamination
	Potential for surface-water contamination
	Water erosion
	Water table
425D2:	
Keswick	Acid soil
	Potential for ground-water contamination
	Potential for surface-water contamination
	Potential poor tilth and compaction
	Previously eroded
	Water erosion
	Water table
430:	
Ackmore	Flooding
	Potential for ground-water contamination
	Potential for surface-water contamination
	Water table
451D2:	
Caleb	Acid soil
	Potential for ground-water contamination
	Potential for surface-water contamination
	Previously eroded
	Water erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
451E2:	
Caleb	Acid soil Potential for ground-water contamination Potential for surface-water contamination Previously eroded Slope Water erosion
452C:	
Lineville	Acid soil Potential for ground-water contamination Potential for surface-water contamination Water erosion Water table
452C2:	
Lineville	Acid soil Potential for ground-water contamination Potential for surface-water contamination Previously eroded Water erosion Water table
453:	
Tuskeego	Potential for ground-water contamination Restricted permeability Water table
470D2:	
Lamoni	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Restricted permeability Water erosion Water table
Shelby	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion
484:	
Lawson	Flooding Potential for ground-water contamination Potential for surface-water contamination Water table
587:	
Chequest	Acid soil Flooding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
587+:	
Chequest	Acid soil Flooding Potential for ground-water contamination Potential for surface-water contamination Water table

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
592C2, 592D2:	
Mystic	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion Water table
711:	
Nodaway	Flooding Potential for ground-water contamination Potential for surface-water contamination
Lawson	Flooding Potential for ground-water contamination Potential for surface-water contamination Water table
792C:	
Armstrong	Potential for ground-water contamination Potential for surface-water contamination Water erosion Water table
792C2:	
Armstrong	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion Water table
792D:	
Armstrong	Potential for ground-water contamination Potential for surface-water contamination Water erosion Water table
792D2, 792D3:	
Armstrong	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion Water table
822C:	
Lamoni	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Restricted permeability Water erosion Water table
822C2:	
Lamoni	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Restricted permeability Water erosion Water table

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
822D:	
Lamoni	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Restricted permeability Water erosion Water table
822D2:	
Lamoni	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Restricted permeability Water erosion Water table
831B, 831C:	
Pershing	Acid soil Potential for ground-water contamination Potential for surface-water contamination Water erosion Water table
831C2:	
Pershing	Acid soil Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion Water table
894D2:	
Bucknell	Acid soil Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Restricted permeability Water erosion Water table
Gara	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion
993D2:	
Gara	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion
Armstrong	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion Water table

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1711:	
Nodaway	Channeled Flooding Potential for ground-water contamination Potential for surface-water contamination
Lawson	Channeled Flooding Potential for ground-water contamination Potential for surface-water contamination Water table
5021:	
Orthents	Nonsoil material
5025:	
Strip mines	Nonsoil material
5040:	
Orthents	Nonsoil material

Agronomic Considerations

(See text for a description of the considerations listed in this table)

Map symbol and soil name	Subsoil phosphorus	Subsoil potassium	Tilth rating
13B: Zook-Olmitz-Vesser	Very low	Very low minus	Fair.
23C, 23C2: Arispe	Very low	Very low plus	Fair.
24D: Shelby	Very low	Very low minus	Good.
24D2, 24E2: Shelby	Very low	Very low minus	Fair.
24E3: Shelby	Very low	Very low minus	Poor.
24F2: Shelby	Very low	Very low minus	Fair.
51, 51+: Vesser	Low	Very low minus	Fair.
51B, 51B+: Vesser	Low	Very low minus	Good.
54: Zook	Medium	Very low plus	Fair.
54+: Zook	Medium	Very low plus	Good.
54B: Zook	Medium	Very low plus	Fair.
65E: Lindley	Low	Very low minus	Good.
65E2: Lindley	Low	Very low minus	Fair.
65F: Lindley	Low	Very low minus	Good.
65F2, 65G: Lindley	Low	Very low minus	Fair.
65G2: Lindley	Low	Very low minus	Poor.
93D2: Shelby-Adair	Very low	Very low minus	Fair.
94D2, 94E2: Mystic-Caleb	Very low	Very low plus	Fair.
131B, 131C: Pershing	Medium	Very low minus	Good.
131C2, 131D2: Pershing	Medium	Very low minus	Fair.

Agronomic Considerations--Continued

Map symbol and soil name	Subsoil phosphorus	Subsoil potassium	Tilth rating
132B, 132C----------- Weller	Medium---------	Very low minus	Good.
132C2, 132D2--------- Weller	Medium---------	Very low minus	Fair.
172------------------ Wabash	Medium---------	Low------------	Fair.
179D2---------------- Gara	Low------------	Very low minus	Fair.
179E----------------- Gara	Low------------	Very low minus	Good.
179E2---------------- Gara	Low------------	Very low minus	Fair.
179E3---------------- Gara	Low------------	Very low minus	Poor.
179F----------------- Gara	Low------------	Very low minus	Good.
179F2---------------- Gara	Low------------	Very low minus	Fair.
179G2---------------- Gara	Low------------	Very low minus	Good.
192C2, 192D2--------- Adair	Very low-------	Very low minus	Fair.
211------------------ Edina	Very low-------	Very low minus	Fair.
220------------------ Nodaway	Medium---------	Very low minus	Good.
222C----------------- Clarinda	Very low-------	Very low minus	Good.
222C2---------------- Clarinda	Very low-------	Very low minus	Fair.
222C3---------------- Clarinda	Very low-------	Very low minus	Very poor.
222D2---------------- Clarinda	Very low-------	Very low minus	Fair.
223C2, 223D2--------- Rinda	Very low-------	Very low minus	Fair.
269, 269+------------ Humeston	Medium---------	Very low minus	Fair.
273B, 273C----------- Olmitz	Very low-------	Low------------	Good.
313D2, 313E2--------- Gosport	Very low-------	Very low minus	Fair.

Agronomic Considerations--Continued

Map symbol and soil name	Subsoil phosphorus	Subsoil potassium	Tilth rating
313F Gosport	Very low	Very low minus	Good.
313F2 Gosport	Very low	Very low minus	Fair.
362 Haig	Low	Very low plus	Fair.
364B Grundy	Low	Very low plus	Good.
423C2, 423D, 423D2 Bucknell	Very low	Very low minus	Fair.
425D Keswick	Very low	Very low minus	Fair.
425D2 Keswick	Very low	Very low minus	Poor.
430 Ackmore	Low	Very low minus	Fair.
451D2, 451E2 Caleb	Very low	Very low plus	Fair.
452C, 452C2 Lineville	Very low	Very low minus	Fair.
453 Tuskeego	Low	Very low minus	Fair.
470D2 Lamoni-Shelby	Very low	Very low minus	Fair.
484 Lawson	Medium	Very low plus	Good.
587, 587+ Chequest	Medium	Very low plus	Fair.
592C2, 592D2 Mystic	Very low	Very low plus	Fair.
711 Nodaway-Lawson	Very low	Very low minus	Fair.
792C, 792C2, 792D, 792D2 Armstrong	Very low	Very low minus	Fair.
792D3 Armstrong	Very low	Very low minus	Poor.
822C Lamoni	Very low	Very low plus	Good.
822C2 Lamoni	Very low	Very low plus	Fair.
822D Lamoni	Very low	Very low plus	Good.

Agronomic Considerations--Continued

Map symbol and soil name	Subsoil phosphorus	Subsoil potassium	Tilth rating
822D2----------------- Lamoni	Very low-------	Very low plus	Fair.
831B, 831C----------- Pershing	Medium---------	Very low minus	Good.
831C2----------------- Pershing	Medium---------	Very low minus	Fair.
894D2----------------- Bucknell-Gara	Very low-------	Very low minus	Fair.
993D2----------------- Gara-Armstrong	Very low-------	Very low minus	Fair.
1711------------------ Nodaway-Lawson	Very low-------	Very low minus	Fair.

Land Capability, Corn Suitability Rating, and Yields per Acre of Crops

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Map symbol and soil name	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Winter wheat
		PI*	Bu	Bu	Bu	Bu
13B		53	124	42	62	50
Zook	2w					
Olmitz	2e					
Vesser	2w					
23C Arispe	3e	55	127	43	64	51
23C2 Arispe	3e	50	123	41	62	49
24D Shelby	3e	50	119	40	60	48
24D2 Shelby	3e	48	115	39	58	46
24E2 Shelby	4e	38	98	33	49	39
24E3 Shelby	6e	35	---	---	45	---
24F2 Shelby	6e	18	---	---	---	---
51 Vesser	2w	70	130	44	65	52
51+ Vesser	2w	71	132	44	66	53
51B Vesser	2w	65	127	43	64	51
51B+ Vesser	2w	66	129	43	65	52
54 Zook	2w	70	126	42	63	50
54+ Zook	2w	75	131	44	66	52
54B Zook	2w	65	123	41	62	49
65E Lindley	6e	30	---	---	42	---
65E2 Lindley	6e	28	---	---	40	---

See footnote at end of table.

Land Capability, Corn Suitability Rating, and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Winter wheat
		PI*	Bu	Bu	Bu	Bu
65F--------------- Lindley	7e	10	---	---	---	---
65F2-------------- Lindley	7e	8	---	---	---	---
65G--------------- Lindley	7e	5	---	---	---	---
65G2-------------- Lindley	7e	5	---	---	---	---
93D2--------------		35	95	32	48	38
Shelby-----------	3e					
Adair------------	4e					
94D2-------------- Mystic-Caleb	4e	16	67	22	34	27
94E2-------------- Mystic-Caleb	6e	12	---	---	25	---
131B-------------- Pershing	3e	67	119	40	60	48
131C-------------- Pershing	3e	49	114	38	57	46
131C2------------- Pershing	3e	45	107	36	54	43
131D2------------- Pershing	4e	31	98	33	49	39
132B-------------- Weller	3e	60	102	34	51	---
132C-------------- Weller	3e	44	97	32	49	39
132C2------------- Weller	3e	40	90	30	45	36
132D2------------- Weller	4e	28	81	27	41	32
172--------------- Wabash	3w	45	86	29	---	34
179D2------------- Gara	4e	43	106	36	53	42
179E-------------- Gara	6e	35	---	---	47	---
179E2------------- Gara	6e	33	---	---	45	---
179E3------------- Gara	6e	30	---	---	41	---

See footnote at end of table.

Land Capability, Corn Suitability Rating, and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Winter wheat
		PI*	Bu	Bu	Bu	Bu
179F------------- Gara	6e	15	---	---	---	---
179F2------------ Gara	7e	13	---	---	---	---
179G2------------ Gara	7e	5	---	---	---	---
192C2------------ Adair	3e	30	82	27	41	33
192D2------------ Adair	4e	15	73	24	37	29
211-------------- Edina	3w	57	107	36	54	43
220-------------- Nodaway	2w	85	145	49	73	58
222C------------- Clarinda	4w	30	82	27	41	33
222C2------------ Clarinda	4w	25	72	24	36	29
222C3------------ Clarinda	6e	15	---	---	---	---
222D2------------ Clarinda	4e	10	63	21	32	25
223C2------------ Rinda	4w	22	63	21	32	25
223D2------------ Rinda	4e	9	54	18	27	22
269-------------- Humeston	3w	58	110	37	55	44
269+------------- Humeston	3w	63	119	40	54	48
273B------------- Olmitz	2e	72	137	46	69	55
273C------------- Olmitz	3e	57	132	44	66	53
313D2------------ Gosport	6e	10	---	---	25	---
313E2------------ Gosport	7e	5	---	---	---	---
313F------------- Gosport	7e	5	---	---	---	---

See footnote at end of table.

Land Capability, Corn Suitability Rating, and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Winter wheat
		PI*	Bu	Bu	Bu	Bu
313F2------------ Gosport	7e	5	---	---	---	---
362-------------- Haig	2w	70	131	44	66	52
364B------------- Grundy	2e	75	133	45	67	53
423C2------------ Bucknell	3e	27	73	24	37	29
423D------------- Bucknell	4e	18	74	25	37	30
423D2------------ Bucknell	4e	13	64	21	32	26
425D------------- Keswick	4e	16	65	22	33	26
425D2------------ Keswick	4e	12	55	18	28	26
430-------------- Ackmore	2w	83	141	47	71	56
451D2------------ Caleb	4e	33	77	26	39	31
451E2------------ Caleb	6e	23	---	---	---	---
452C------------- Lineville	3e	36	92	31	46	37
452C2------------ Lineville	3e	31	85	28	43	34
453-------------- Tuskeego	3w	53	105	35	53	42
470D2------------		25	84	28	42	34
Lamoni----------	4e					
Shelby----------	3e					
484-------------- Lawson	2w	90	157	53	79	63
587-------------- Chequest	2w	65	120	40	60	48
587+------------- Chequest	2w	67	124	42	62	50
592C2------------ Mystic	3e	20	65	22	33	26
592D2------------ Mystic	4e	5	56	19	28	22

See footnote at end of table.

Land Capability, Corn Suitability Rating, and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Winter wheat
		PI*	Bu	Bu	Bu	Bu
711		87	149	50	74	60
Nodaway	2w					
Lawson	5w					
792C	3e	31	83	28	42	33
Armstrong						
792C2	3e	27	73	24	37	29
Armstrong						
792D	4e	18	74	25	37	30
Armstrong						
792D2	4e	13	64	21	32	26
Armstrong						
792D3	6e	5	---	---	22	---
Armstrong						
822C	3e	35	92	31	46	37
Lamoni						
822C2	3e	30	82	27	41	33
Lamoni						
822D	4e	20	83	28	42	33
Lamoni						
822D2	4e	15	73	24	37	29
Lamoni						
831B	3e	67	119	40	60	48
Pershing						
831C	3e	49	114	38	57	46
Pershing						
831C2	3e	45	107	36	54	43
Pershing						
894D2	4e	24	79	27	40	---
Bucknell-Gara						
993D2	4e	31	85	28	43	34
Gara-Armstrong						
1711	5w	25	---	---	---	---
Nodaway-Lawson						
5021.						
Orthents						
5025	8s	---	---	---	---	---
Strip mines						
5040.						
Orthents						

* Productivity index: On a scale of 5 to 100.

Land Capability and Yields per Acre of Crops and Pasture

Map symbol and soil name	Land capability	Bromegrass-alfalfa	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass
		AUM*	Tons	AUM*	AUM*
13B		---	3.7	3.1	5.1
Zook	2w				
Olmitz	2e				
Vesser	2w				
23C Arispe	3e	8.6	5.1	3.1	5.2
23C2 Arispe	3e	8.3	4.9	3.0	5.0
24D Shelby	3e	8.4	5.0	2.9	4.9
24D2 Shelby	3e	8.1	4.8	2.8	4.7
24E2 Shelby	4e	6.9	4.1	2.4	4.0
24E3 Shelby	6e	6.2	3.7	2.2	3.6
24F2 Shelby	6e	6.2	---	2.2	3.6
51 Vesser	2w	6.5	3.9	3.2	5.3
51+ Vesser	2w	6.5	4.0	3.2	5.4
51B Vesser	2w	6.4	3.8	3.1	5.2
51B+ Vesser	2w	6.4	3.9	3.2	5.3
54 Zook	2w	---	3.8	3.1	5.2
54+ Zook	2w	---	3.9	3.2	5.4
54B Zook	2w	---	3.7	3.0	5.0
65E Lindley	6e	---	3.5	2.1	3.4
65E2 Lindley	6e	---	3.4	2.0	3.3
65F Lindley	7e	---	---	1.8	3.0
65F2 Lindley	7e	---	---	1.7	2.9

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Bromegrass-alfalfa	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass
		AUM*	Tons	AUM*	AUM*
65G------------- Lindley	7e	---	---	1.7	2.8
65G2------------ Lindley	7e	---	---	1.6	2.7
93D2------------		8.1	3.8	2.3	3.9
Shelby----------	3e				
Adair-----------	4e				
94D2------------ Mystic-Caleb	4e	3.7	2.7	1.6	2.7
94E2------------ Mystic-Caleb	6e	3.2	2.0	1.2	2.1
131B------------ Pershing	3e	8.0	4.8	2.9	4.9
131C------------ Pershing	3e	7.6	4.6	2.8	4.7
131C2----------- Pershing	3e	7.2	4.3	2.6	4.4
131D2----------- Pershing	4e	6.6	3.9	2.4	4.0
132B------------ Weller	3e	7.4	4.3	2.6	4.2
132C------------ Weller	3e	7.0	4.1	2.4	4.0
132C2----------- Weller	3e	6.5	3.8	2.2	3.7
132D2----------- Weller	4e	5.9	3.4	2.0	3.3
172------------- Wabash	3w	---	2.6	2.1	3.5
179D2----------- Gara	4e	7.4	4.5	2.6	4.3
179E------------ Gara	6e	6.5	3.9	2.3	3.8
179E2----------- Gara	6e	6.2	3.7	2.2	3.6
179E3----------- Gara	6e	5.7	3.4	2.0	3.3
179F------------ Gara	6e	---	---	2.0	3.4
179F2----------- Gara	7e	---	---	1.9	3.2

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Bromegrass-alfalfa	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass
		AUM*	Tons	AUM*	AUM*
179G2------------ Gara	7e	---	---	1.8	3.0
192C2------------ Adair	3e	5.5	3.3	2.0	3.4
192D2------------ Adair	4e	4.6	2.9	1.8	3.0
211-------------- Edina	3w	---	3.2	2.6	4.4
220-------------- Nodaway	2w	10.7	6.1	3.6	5.9
222C------------- Clarinda	4w	4.1	2.5	2.0	3.4
222C2------------ Clarinda	4w	3.6	2.2	1.8	3.0
222C3------------ Clarinda	6e	2.6	1.6	1.3	2.1
222D2------------ Clarinda	4e	3.2	1.9	1.5	2.6
223C2------------ Rinda	4w	3.2	1.9	1.5	2.6
223D2------------ Rinda	4e	2.7	1.6	1.3	2.2
269-------------- Humeston	3w	5.5	3.3	2.7	4.5
269+------------- Humeston	3w	5.5	3.6	2.9	4.9
273B------------- Olmitz	2e	9.6	5.8	3.4	5.6
273C------------- Olmitz	3e	9.3	5.5	3.2	5.4
313D2------------ Gosport	6e	3.5	2.1	1.2	2.1
313E2------------ Gosport	7e	2.3	---	0.8	1.4
313F------------- Gosport	7e	---	---	0.8	1.4
313F2------------ Gosport	7e	2.3	---	0.6	0.9
362-------------- Haig	2w	6.6	3.9	3.2	5.4

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Bromegrass-alfalfa	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass
		AUM*	Tons	AUM*	AUM*
364B------------- Grundy	2e	---	5.3	3.3	5.5
423C2------------ Bucknell	3e	4.9	2.9	1.8	3.0
423D------------- Bucknell	4e	4.9	3.0	1.8	3.0
423D2------------ Bucknell	4e	4.3	2.6	1.6	2.6
425D------------- Keswick	4e	4.6	2.7	1.6	2.7
425D2------------ Keswick	4e	3.9	2.3	1.4	2.3
430-------------- Ackmore	2w	7.1	4.2	3.5	5.8
451D2------------ Caleb	4e	5.8	3.2	1.9	3.2
451E2------------ Caleb	6e	4.6	2.5	1.5	2.5
452C------------- Lineville	3e	6.2	3.7	2.3	3.8
452C2------------ Lineville	3e	5.7	3.4	2.1	3.5
453-------------- Tuskeego	3w	5.3	3.2	2.6	4.3
470D2------------		4.9	3.4	2.1	3.4
Lamoni----------	4e				
Shelby----------	3e				
484-------------- Lawson	2w	---	6.3	3.9	6.4
587-------------- Chequest	2w	6.0	3.6	3.0	4.9
587+------------- Chequest	2w	6.0	3.7	3.1	5.1
592C2------------ Mystic	3e	4.3	2.6	1.6	2.7
592D2------------ Mystic	4e	3.7	2.2	1.4	2.3
711--------------		10.7	5.9	3.7	6.1
Nodaway---------	2w				
Lawson----------	5w				

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Bromegrass-alfalfa	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass
		AUM*	Tons	AUM*	AUM*
792C------------- Armstrong	3e	5.5	3.3	2.0	3.4
792C2------------ Armstrong	3e	4.9	2.9	1.8	3.0
792D------------- Armstrong	4e	4.9	3.0	1.8	3.0
792D2------------ Armstrong	4e	4.3	2.6	1.6	2.6
792D3------------ Armstrong	6e	2.9	1.8	1.1	1.8
822C------------- Lamoni	3e	6.2	3.7	2.3	3.8
822C2------------ Lamoni	3e	5.5	3.3	2.0	3.4
822D------------- Lamoni	4e	5.5	3.3	2.0	3.4
822D2------------ Lamoni	4e	4.9	2.9	1.8	3.0
831B------------- Pershing	3e	8.0	4.8	2.9	4.9
831C------------- Pershing	3e	7.6	4.6	2.8	4.7
831C2------------ Pershing	3e	7.2	4.3	2.6	4.4
894D2------------ Bucknell-Gara	4e	4.3	3.2	1.9	3.2
993D2------------ Gara-Armstrong	4e	7.4	3.4	2.1	3.5
1711------------- Nodaway-Lawson	5w	---	---	4.0	5.5
5021. Orthents					
5025------------- Strip mines	8s	---	---	---	---
5040. Orthents					

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

Prime Farmland

Map symbol	Soil name
13B	Zook-Olmitz-Vesser complex, 0 to 5 percent slopes (where drained)
51	Vesser silt loam, 0 to 2 percent slopes (where drained)
51+	Vesser silt loam, 0 to 2 percent slopes, overwash (where drained)
51B	Vesser silt loam, 2 to 5 percent slopes (where drained)
51B+	Vesser silt loam, 2 to 5 percent slopes, overwash (where drained)
54	Zook silty clay loam, 0 to 2 percent slopes (where drained)
54+	Zook silty clay loam, 0 to 2 percent slopes, overwash (where drained)
54B	Zook silty clay loam, 2 to 5 percent slopes (where drained)
131B	Pershing silt loam, 2 to 5 percent slopes
132B	Weller silt loam, 2 to 5 percent slopes
172	Wabash silty clay, 0 to 2 percent slopes (where drained and either protected from flooding or not frequently flooded during the growing season)
211	Edina silt loam, depressional, 0 to 1 percent slopes (where drained)
220	Nodaway silt loam, 0 to 2 percent slopes (where protected from flooding or not frequently flooded during the growing season)
269	Humeston silty clay loam, 0 to 2 percent slopes (where drained)
269+	Humeston silt loam, 0 to 2 percent slopes, overwash (where drained)
362	Haig silt loam, 0 to 2 percent slopes (where drained)
364B	Grundy silty clay loam, 2 to 5 percent slopes
430	Ackmore silt loam, 0 to 2 percent slopes (where protected from flooding or not frequently flooded during the growing season)
453	Tuskeego silt loam, 0 to 2 percent slopes (where drained)
484	Lawson silt loam, 0 to 2 percent slopes (where protected from flooding or not frequently flooded during the growing season)
587	Chequest silty clay loam, 0 to 2 percent slopes (where drained and either protected from flooding or not frequently flooded during the growing season)
587+	Chequest silt loam, 0 to 2 percent slopes, overwash (where drained and either protected from flooding or not frequently flooded during the growing season)
711	Nodaway-Lawson complex, 0 to 2 percent slopes (where protected from flooding or not frequently flooded during the growing season)
831B	Pershing silt loam, bench, 2 to 5 percent slopes

Windbreaks and Environmental Plantings

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
13B:					
Zook	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Norway spruce, Austrian pine, blue spruce, northern whitecedar.	Eastern white pine	Pin oak.
Olmitz	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Vesser	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Norway spruce, Austrian pine, blue spruce, northern whitecedar.	Eastern white pine	Pin oak.
23C, 23C2:					
Arispe	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
24D, 24D2, 24E2, 24E3, 24F2:					
Shelby	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
51, 51+, 51B, 51B+:					
Vesser	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Norway spruce, Austrian pine, blue spruce, northern whitecedar.	Eastern white pine	Pin oak.
54, 54+, 54B:					
Zook	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Norway spruce, Austrian pine, blue spruce, northern whitecedar.	Eastern white pine	Pin oak.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
65E, 65E2, 65F, 65F2, 65G, 65G2: Lindley	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
93D2: Shelby	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Adair	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---
94D2, 94E2: Mystic	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---
Caleb	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
131B, 131C, 131C2, 131D2: Pershing	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---
132B, 132C, 132C2, 132D2: Weller	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
172: Wabash	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Norway spruce, Austrian pine, blue spruce, northern whitecedar.	Eastern white pine	Pin oak.
179D2, 179E, 179E2, 179E3, 179F, 179F2, 179G2: Gara	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
192C2, 192D2: Adair	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---
211: Edina	Redosier dogwood	Silky dogwood, holly, American cranberrybush.	Washington hawthorn, green ash, Austrian pine, northern whitecedar.	Red maple, eastern white pine.	Pin oak.
220: Nodaway	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Austrian pine, blue spruce, northern whitecedar.	Norway spruce	Eastern white pine, pin oak.
222C, 222C2, 222C3, 222D2: Clarinda	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange.	Austrian pine, eastern white pine, pin oak.	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
223C2, 223D2: Rinda	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---
269, 269+: Humeston	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Norway spruce, Austrian pine, blue spruce, northern whitecedar.	Eastern white pine	Pin oak.
273B, 273C: Olmitz	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
313D2, 313E2, 313F, 313F2: Gosport	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---
362: Haig	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Norway spruce, Austrian pine, blue spruce, northern whitecedar.	Eastern white pine	Pin oak.
364B: Grundy	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
423C2, 423D, 423D2: Bucknell-------	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---
425D, 425D2: Keswick---------	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---
430: Ackmore---------	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Austrian pine, blue spruce, northern whitecedar.	Norway spruce-----	Eastern white pine, pin oak.
451D2, 451E2: Caleb-----------	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
452C, 452C2: Lineville-------	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---
453: Tuskeego--------	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Norway spruce, Austrian pine, blue spruce, northern whitecedar.	Eastern white pine	Pin oak.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
470D2:					
Lamoni	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---
Shelby	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
484:					
Lawson	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Austrian pine, blue spruce, northern whitecedar.	Norway spruce	Eastern white pine, pin oak.
587, 587+:					
Chequest	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Norway spruce, Austrian pine, blue spruce, northern whitecedar.	Eastern white pine	Pin oak.
592C2, 592D2:					
Mystic	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---
711:					
Nodaway	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Austrian pine, blue spruce, northern whitecedar.	Norway spruce	Eastern white pine, pin oak.
Lawson	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Austrian pine, blue spruce, northern whitecedar.	Norway spruce	Eastern white pine, pin oak.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
792C, 792C2, 792D, 792D2, 792D3:					
Armstrong------	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---
822C, 822C2, 822D, 822D2:					
Lamoni---------	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---
831B, 831C, 831C2:					
Pershing-------	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---
894D2:					
Bucknell--------	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---
Gara------------	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
993D2:					
Gara------------	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
993D2:					
Armstrong-------	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---
1711:					
Nodaway---------	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Austrian pine, blue spruce, northern whitecedar.	Norway spruce-----	Eastern white pine, pin oak.
Lawson----------	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Austrian pine, blue spruce, northern whitecedar.	Norway spruce-----	Eastern white pine, pin oak.

Windbreak Suitability Groups

(See text for a description of the characteristics of the soils in each group. Absence of an entry indicates that a windbreak suitability group is not assigned. Suitable shrubs and trees with their mature heights are listed in the "Windbreaks and Environmental Plantings" table)

Map symbol and soil name	Windbreak suitability group
13B:	
Zook	2
Olmitz	3
Vesser	2
23C, 23C2:	
Arispe	3
24D, 24D2, 24E2, 24E3, 24F2:	
Shelby	3
51, 51+, 51B, 51B+:	
Vesser	2
54, 54+, 54B:	
Zook	2
65E, 65E2, 65F, 65F2, 65G, 65G2:	
Lindley	3
93D2:	
Shelby	3
Adair	4
94D2, 94E2:	
Mystic	4
Caleb	3
131B, 131C, 131C2, 131D2:	
Pershing	4
132B, 132C, 132C2, 132D2:	
Weller	4
172:	
Wabash	2
179D2, 179E, 179E2, 179E3, 179F, 179F2, 179G2:	
Gara	3
192C2, 192D2:	
Adair	4

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
211:	
Edina	2
220:	
Nodaway	1
222C, 222C2, 222C3, 222D2:	
Clarinda	4
223C2, 223D2:	
Rinda	4
269, 269+:	
Humeston	2
273B, 273C:	
Olmitz	3
313D2, 313E2, 313F, 313F2:	
Gosport	4
362:	
Haig	2
364B:	
Grundy	4
423C2, 423D, 423D2:	
Bucknell	4
425D, 425D2:	
Keswick	4
430:	
Ackmore	1
451D2, 451E2:	
Caleb	3
452C, 452C2:	
Lineville	4
453:	
Tuskeego	2
470D2:	
Lamoni	4C
Shelby	3
484:	
Lawson	1
587, 587+:	
Chequest	2
592C2, 592D2:	
Mystic	4

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
711:	
Nodaway	1
Lawson	1
792C, 792C2, 792D, 792D2, 792D3:	
Armstrong	4
822C, 822C2, 822D, 822D2:	
Lamoni	4C
831B, 831C, 831C2:	
Pershing	4
894D2:	
Bucknell	4
Gara	3
993D2:	
Gara	3
Armstrong	4
1711:	
Nodaway	1
Lawson	1

Forest Land

The information in the table "Woodland Management and Productivity" at the end of this section can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *N*, snowpack. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and N.

In the table, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment and season of use are not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they

do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

Plant competition ratings indicate the degree to which undesirable species are expected to invade and grow when openings are made in the tree canopy. The main factors that affect plant competition are depth to the water table and the available water capacity. A rating of *slight* indicates that competition from undesirable plants is not likely to prevent natural regeneration or suppress the more desirable species. Planted seedlings can become established without undue competition. A rating of *moderate* indicates that competition may delay the establishment of desirable species. Competition may hamper stand development, but it will not prevent the eventual development of fully stocked stands. A rating of *severe* indicates that competition can be expected to prevent regeneration unless precautionary measures are applied.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *productivity class*. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *productivity class*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic meters per hectare per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

Trees to plant are those that are suitable for commercial wood production.

Woodland Management and Productivity

(Only the soils suitable for production of commercial trees are listed)

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Productivity class*	Trees to plant
65E, 65E2, 65F, 65F2, 65G, 65G2:										
Lindley	3R	Moderate	Moderate	Slight	Slight	Severe	White oak	56	3	White oak, northern red oak, black oak.
							Northern red oak	61	3	
							Black oak	63	3	
94D2:										
Mystic	3A	Slight	Slight	Slight	Slight	Moderate	White oak	55	3	Sugar maple, black walnut, red pine, eastern white pine.
Caleb	3A	Slight	Slight	Slight	Slight	Slight	White oak	55	3	Sugar maple, black walnut, red pine, eastern white pine.
							Northern red oak	55	3	
94E2:										
Mystic	3A	Slight	Slight	Slight	Slight	Moderate	White oak	55	3	Sugar maple, black walnut, red pine, eastern white pine.
Caleb	3R	Moderate	Moderate	Slight	Slight	Slight	White oak	55	3	Sugar maple, black walnut, red pine, eastern white pine.
							Northern red oak	55	3	
131B, 131C, 131C2, 131D2:										
Pershing	3C	Slight	Slight	Severe	Severe	Slight	White oak	55	3	Red pine, eastern white pine, white oak.
132B, 132C, 132C2, 132D2:										
Weller	3C	Slight	Slight	Severe	Severe	Slight	White oak	55	3	Sugar maple, black walnut, red pine, eastern white pine.
172:										
Wabash	4W	Slight	Severe	Moderate	Moderate	Severe	Pin oak	75	4	Pecan, eastern cottonwood, pin oak.

See footnote at end of table.

Woodland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Productivity class*	Trees to plant
179D2:										
Gara	3A	Slight	Slight	Slight	Slight	Slight	White oak	55	3	Red pine, eastern white pine, white oak, northern red oak.
							Northern red oak	55	3	
179E, 179E2:										
Gara	3R	Moderate	Moderate	Slight	Slight	Slight	White oak	55	3	Red pine, eastern white pine, white oak, northern red oak.
							Northern red oak	55	3	
179E3:										
Gara	3R	Moderate	Moderate	Slight	Slight	Slight	Northern red oak	55	3	Red pine, eastern white pine, white oak.
							White oak	55	3	
179F, 179F2, 179G2:										
Gara	3R	Moderate	Moderate	Slight	Slight	Slight	White oak	55	3	Red pine, eastern white pine, white oak, northern red oak.
							Northern red oak	55	3	
220:										
Nodaway	3A	Slight	Slight	Slight	Slight	Moderate	White oak	65	3	Sugar maple, black walnut, European larch, red pine, eastern white pine.
223C2, 223D2:										
Rinda	2W	Slight	Severe	Moderate	Moderate	Severe	White oak	45	2	Silver maple, hackberry, green ash, eastern redcedar, Norway spruce, white spruce, American sycamore.
							Northern red oak	45	2	
313D2:										
Gosport	2C	Slight	Slight	Severe	Severe	Slight	White oak	45	2	Norway spruce, white spruce, red pine, eastern white pine, Scotch pine, cottonwood.

See footnote at end of table.

Woodland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Productivity class*	Trees to plant
313E2, 313F, 313F2: Gosport	2R	Moderate	Moderate	Severe	Severe	Slight	White oak	45	2	Norway spruce, white spruce, red pine, eastern white pine, Scotch pine, cottonwood.
423C2, 423D, 423D2: Bucknell	2C	Slight	Slight	Slight	Moderate	Slight	White oak	50	2	Silver maple, hackberry, green ash, eastern redcedar, American sycamore.
							Northern red oak	50	2	
425D, 425D2: Keswick	3C	Slight	Slight	Moderate	Severe	Slight	White oak	55	3	Sugar maple, red pine, eastern white pine.
							Northern red oak	55	3	
430: Ackmore	3A	Slight	Slight	Slight	Slight	Moderate	White oak	65	3	Sugar maple, black walnut, red pine, eastern white pine, cottonwood.
451D2: Caleb	3A	Slight	Slight	Slight	Slight	Slight	White oak	55	3	Sugar maple, black walnut, red pine, eastern white pine.
							Northern red oak	55	3	
451E2: Caleb	3R	Moderate	Moderate	Slight	Slight	Slight	White oak	55	3	Sugar maple, black walnut, red pine, eastern white pine.
							Northern red oak	55	3	
452C, 452C2: Lineville	3A	Slight	Slight	Slight	Slight	Slight	White oak	55	3	Sugar maple, Norway spruce, white spruce, red pine, eastern white pine.

See footnote at end of table.

Woodland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Productivity class*	Trees to plant
453:										
Tuskeego--------	2W	Slight	Severe	Moderate	Moderate	Severe	Silver maple--------	80	2	Silver maple, green ash, American sycamore, eastern cottonwood, laurel willow, northern whitecedar.
							Eastern cottonwood--	90	7	
484:										
Lawson----------	2A	Slight	Slight	Slight	Slight	Severe	Silver maple--------	70	2	Silver maple, white ash, white spruce.
							Red maple-----------	---	---	
							White ash-----------	---	---	
587, 587+:										
Chequest--------	2W	Slight	Severe	Moderate	Moderate	Severe	Silver maple--------	80	2	Silver maple, green ash, American sycamore, eastern cottonwood, laurel willow, northern whitecedar.
							Eastern cottonwood--	90	7	
592C2, 592D2:										
Mystic----------	3A	Slight	Slight	Slight	Slight	Moderate	White oak-----------	55	3	Sugar maple, black walnut, red pine, eastern white pine.
711:										
Nodaway---------	3A	Slight	Slight	Slight	Slight	Moderate	White oak-----------	65	3	Sugar maple, black walnut, European larch, red pine, eastern white pine.
Lawson----------	2A	Slight	Slight	Slight	Slight	Severe	Silver maple--------	70	2	Silver maple, white ash, white spruce.
							Red maple-----------	---	---	
							White ash-----------	---	---	
792C, 792C2, 792D, 792D2, 792D3:										
Armstrong------	3C	Slight	Slight	Moderate	Severe	Slight	White oak-----------	55	3	Sugar maple, European larch, red pine, eastern white pine.
							Northern red oak----	55	3	

See footnote at end of table.

Woodland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Productivity class*	Trees to plant
831B, 831C, 831C2: Pershing	3C	Slight	Slight	Severe	Severe	Slight	White oak	55	3	Red pine, eastern white pine, white oak.
894D2: Bucknell	2C	Slight	Slight	Slight	Moderate	Slight	White oak Northern red oak	50 50	2 2	Silver maple, hackberry, green ash, eastern redcedar, American sycamore.
Gara	3A	Slight	Slight	Slight	Slight	Slight	White oak Northern red oak	55 55	3 3	Red pine, eastern white pine, white oak, northern red oak.
993D2: Gara	3A	Slight	Slight	Slight	Slight	Slight	White oak Northern red oak	55 55	3 3	Red pine, eastern white pine, white oak, northern red oak.
Armstrong	3C	Slight	Slight	Moderate	Severe	Slight	White oak Northern red oak	55 55	3 3	Sugar maple, European larch, red pine, eastern white pine.
1711: Nodaway	3A	Slight	Slight	Slight	Slight	Moderate	White oak	65	3	Sugar maple, black walnut, European larch, red pine, eastern white pine.
Lawson	2W	Slight	Moderate	Slight	Slight	Severe	Silver maple Red maple White ash	70 --- ---	2 --- ---	Silver maple, white ash, white spruce.

* Productivity class is the yield in cubic meters per hectare per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

Recreation

The soils of the survey area are rated in the table "Recreational Development" according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites, and either access to public sewer lines or the capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degrees, for recreational uses by the duration of flooding and the season when it occurs. Onsite assessment of the height, duration, intensity, and frequency of flooding is essential in planning recreational facilities.

Camp areas are tracts of land used intensively as sites for tents, trailers, and campers and for outdoor activities that accompany such sites. These areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The soils are rated on the basis of soil properties that influence the ease of developing camp areas and performance of the areas after development. Also considered are the soil properties that influence trafficability and promote the growth of vegetation after heavy use.

Picnic areas are natural or landscaped tracts of land that are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The soils are rated on the basis of soil properties that influence the cost of shaping the site, trafficability, and the growth of vegetation after development. The surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Playgrounds are areas used intensively for baseball, football, or similar activities. These areas require a nearly level soil that is free of stones and that can withstand heavy foot traffic and maintain an adequate cover of vegetation. The soils are rated on the basis of soil properties that influence the cost of shaping the site, trafficability, and the growth of vegetation. Slope and stoniness are the main concerns in developing playgrounds. The surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Paths and trails are areas used for hiking and horseback riding. The areas should require little or no cutting and filling during site preparation. The soils are rated on the basis of soil properties that influence trafficability and erodibility. Paths and trails should remain firm under foot traffic and not be dusty when dry.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

The interpretive ratings in this table help engineers, planners, and others to understand how soil properties influence recreational uses. Ratings for proposed uses are given in terms of limitations. Only the most restrictive features are listed. Other features may limit a specific recreational use.

The degree of soil limitation is expressed as slight, moderate, or severe.

Slight means that soil properties are favorable for the rated use. The limitations are minor and can be easily overcome. Good performance and low maintenance are expected.

Moderate means that soil properties are moderately favorable for the rated use. The limitations can be overcome or modified by special planning, design, or maintenance. During some part of the year, the expected performance may be less desirable than that of soils rated *slight*.

Severe means that soil properties are unfavorable for the rated use. Examples of limitations are slope, bedrock near the surface, flooding, and a seasonal high water table. These limitations generally require major soil reclamation, special design, or intensive

maintenance. Overcoming the limitations generally is difficult and costly.

The information in the table "Recreational Development" can be supplemented by other information in this survey, for example, interpretations for dwellings without basements and for local roads and streets in the table "Building Site Development" and interpretations for septic tank absorption fields in the table "Sanitary Facilities."

Recreational Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
13B:					
Zook	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Olmitz	Slight	Slight	Moderate: slope.	Slight	Slight.
Vesser	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
23C, 23C2:					
Arispe	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Slight.
24D, 24D2:					
Shelby	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
24E2:					
Shelby	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
24E3:					
Shelby	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
24F2:					
Shelby	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
51, 51+:					
Vesser	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
51B, 51B+:					
Vesser	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
54, 54+:					
Zook	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
54B:					
Zook	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
65E, 65E2, 65F, 65F2:					
Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
65G, 65G2:					
Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
93D2:					
Shelby	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
Adair	Severe: wetness.	Moderate: slope, wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope.
94D2:					
Mystic	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope.
Caleb	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
94E2:					
Mystic	Severe: slope, wetness.	Severe: slope.	Severe: slope, wetness.	Moderate: wetness, slope.	Severe: slope.
Caleb	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
131B:					
Pershing	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Slight.
131C, 131C2:					
Pershing	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Slight.
131D2:					
Pershing	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
132B:					
Weller	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Slight.
132C, 132C2:					
Weller	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Slight.
132D2:					
Weller	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
172:					
Wabash	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.
179D2:					
Gara	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
179E, 179E2:					
Gara	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
179E3:					
Gara	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
179F, 179F2:					
Gara	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
179G2:					
Gara	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
192C2:					
Adair	Severe: wetness.	Moderate: wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
192D2:					
Adair	Severe: wetness.	Moderate: slope, wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope.
211:					
Edina	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
220:					
Nodaway	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
222C, 222C2:					
Clarinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
222C3:					
Clarinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness.
222D2:					
Clarinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness, slope.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
223C2:					
Rinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
223D2:					
Rinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness, slope.
269, 269+:					
Humeston	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
273B:					
Olmitz	Slight	Slight	Moderate: slope.	Slight	Slight.
273C:					
Olmitz	Slight	Slight	Severe: slope.	Slight	Slight.
313D2:					
Gosport	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope, depth to rock.
313E2, 313F, 313F2:					
Gosport	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Severe: slope.
362:					
Haig	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
364B:					
Grundy	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Moderate: wetness.	Moderate: wetness.
423C2:					
Bucknell	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
423D, 423D2:					
Bucknell	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness, slope.
425D:					
Keswick	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
425D2:					
Keswick	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness, slope.
430:					
Ackmore	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
451D2:					
Caleb	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
451E2:					
Caleb	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
452C, 452C2:					
Lineville	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness.
453:					
Tuskeego	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
470D2:					
Lamoni	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness, slope.
Shelby	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
484:					
Lawson	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
587, 587+:					
Chequest	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
592C2:					
Mystic	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
592D2:					
Mystic	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
711:					
Nodaway	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Lawson	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
792C, 792C2:					
Armstrong	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
792D, 792D2:					
Armstrong	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope.
792D3:					
Armstrong	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness, slope.
822C, 822C2:					
Lamoni	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
822D, 822D2:					
Lamoni	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness, slope.
831B:					
Pershing	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Slight.
831C, 831C2:					
Pershing	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Slight.
894D2:					
Bucknell	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness, slope.
Gara	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
993D2:					
Gara	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
Armstrong	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope.
1711:					
Nodaway	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Lawson	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
5021: Orthents.					
5025:					
Strip mines	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.
5040: Orthents.					

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. If food, cover, or water is missing, inadequate, or inaccessible, wildlife will be scarce or will not inhabit the area.

If the soils have potential for habitat development, wildlife habitat can be created or improved by planting appropriate vegetation, properly managing the existing plant cover, and fostering the natural establishment of desirable plants.

Elements of Wildlife Habitat

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants used by wildlife. Examples are corn, soybeans, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes planted for wildlife food and cover. Examples are bromegrass, timothy, orchardgrass, clover, alfalfa, wheatgrass, and birdsfoot trefoil.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Examples are bluestems, indiangrass, goldenrod, lambsquarters, dandelions, blackberry, ragweed, wheatgrass, and nightshade.

The major soil properties affecting the growth of grain and forage crops and wild herbaceous plants are depth of the root zone, texture of the surface layer, the amount of water available to plants, wetness, salinity, and flooding. The length of the growing season also is important.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage that wildlife eat. Examples are oak, poplar, box elder, birch, maple, green ash, willow, and American elm. Examples of fruit-producing shrubs that are suitable for planting on soils that have good potential for these plants are honeysuckle, American plum, redosier dogwood, chokecherry, highbush cranberry, elderberry, blackberry, raspberry, gooseberry, silver buffaloberry, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover that provides habitat or supplies food in the form of browse, seed, or fruit-like cones. Examples are pine, spruce, and redcedar.

The major soil properties affecting the growth of hardwood and coniferous trees and shrubs are depth of the root zone, the amount of water available to plants, and wetness.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Wetland plants produce food or cover for wetland wildlife. Examples of these plants are smartweeds, wild millet, rushes, sedges, bulrushes, arrowhead, waterplantain, cattail, prairie cordgrass, bluejoint grass, asters, and beggarticks.

The major soil properties affecting wetland plants are texture of the surface layer, wetness, acidity or alkalinity, and slope.

Shallow water areas have an average depth of less than 5 feet. They are useful as habitat for some wildlife species. They are naturally wet areas or are created by dams, levees, or water-control measures in marshes or streams. Examples are waterfowl feeding areas, wildlife watering developments, beaver ponds, and other wildlife ponds.

The major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability.

Kinds of Wildlife Habitat

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, and shrubs. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include Hungarian partridge, ring-necked pheasant, bobwhite quail, meadowlark, field sparrow, killdeer, cottontail rabbit, and red fox.

Habitat for woodland wildlife consists of areas of hardwoods or conifers or a mixture of these and associated grasses, legumes, and wild herbaceous

plants. The wildlife attracted to this habitat include wild turkey, ruffed grouse, thrushes, woodpeckers, owls, tree squirrels, raccoon, and white-tailed deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas, bogs, or flood plains that support water-tolerant plants. The wildlife attracted to this habitat include ducks, geese, herons, bitterns, rails, kingfishers, muskrats, otter, mink, and beaver.

Wildlife Habitat

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
13B:										
Zook	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
Olmitz	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
Vesser	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
23C, 23C2:										
Arispe	Good	Good	Good	Good	Good	Very poor.	Poor	Good	Good	Very poor.
24D, 24D2:										
Shelby	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
24E2, 24E3, 24F2:										
Shelby	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
51, 51+:										
Vesser	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
51B, 51B+:										
Vesser	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
54, 54+, 54B:										
Zook	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
65E, 65E2, 65F, 65F2:										
Lindley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
65G, 65G2:										
Lindley	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
93D2:										
Shelby	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Adair	Fair	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
94D2:										
Mystic	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
Caleb	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
94E2:										
Mystic	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Caleb	Poor	Good	Fair	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
131B:										
Pershing	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
131C, 131C2, 131D2: Pershing	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
132B: Weller	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
132C, 132C2, 132D2: Weller	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
172: Wabash	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
179D2: Gara	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Poor.
179E, 179E2, 179E3, 179F, 179F2: Gara	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
179G2: Gara	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
192C2, 192D2: Adair	Fair	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
211: Edina	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
220: Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
222C, 222C2, 222C3, 222D2: Clarinda	Poor	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Fair	Poor.
223C2, 223D2: Rinda	Poor	Fair	Poor	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
269, 269+: Humeston	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
273B: Olmitz	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
273C: Olmitz	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
313D2, 313E2, 313F, 313F2: Gosport	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
362:										
Haig	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
364B:										
Grundy	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
423C2, 423D, 423D2:										
Bucknell	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Very poor.
425D, 425D2:										
Keswick	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
430:										
Ackmore	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
451D2:										
Caleb	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
451E2:										
Caleb	Poor	Good	Fair	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
452C, 452C2:										
Lineville	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
453:										
Tuskeego	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
470D2:										
Lamoni	Fair	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
Shelby	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
484:										
Lawson	Good	Good	Fair	Good	Good	Fair	Fair	Good	Good	Fair.
587, 587+:										
Chequest	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
592C2, 592D2:										
Mystic	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
711:										
Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
Lawson	Good	Good	Fair	Good	Good	Fair	Fair	Good	Good	Fair.
792C, 792C2, 792D, 792D2, 792D3:										
Armstrong	Fair	Good	Fair	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
822C, 822C2, 822D, 822D2:										
Lamoni	Fair	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
831B:										
Pershing--------	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
831C, 831C2:										
Pershing--------	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
894D2:										
Bucknell--------	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Very poor.
Gara------------	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Poor.
993D2:										
Gara------------	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Poor.
Armstrong-------	Fair	Good	Fair	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
1711:										
Nodaway---------	Poor	Fair	Fair	Poor	Poor	Good	Fair	Poor	Poor	Fair.
Lawson----------	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
5021:										
Orthents.										
5025:										
Strip mines-----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
5040:										
Orthents.										

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

The table "Building Site Development" shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties,

site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills generally are limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, potential for frost action, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of salts affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

The table "Sanitary Facilities" shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. It also shows the suitability of the soils for use as a daily cover for landfill.

Soil properties are important in selecting sites for sanitary facilities and in identifying limiting soil properties and site features to be considered in planning, design, and installation. Soil limitation ratings of *slight, moderate,* or *severe* are given for septic tank absorption fields, sewage lagoons, and trench and area sanitary landfills. Soil suitability ratings of *good, fair,* and *poor* are given for daily cover for landfill.

A rating of *slight* or *good* indicates that the soils have no limitations or that the limitations can be easily overcome. Good performance and low maintenance can be expected. A rating of *moderate* or *fair* indicates that the limitations should be recognized but generally can be overcome by good management or special design. A rating of *severe* or *poor* indicates that overcoming the limitations is difficult or impractical. Increased maintenance may be required.

Septic tank absorption fields are areas in which subsurface systems of tile or perforated pipe distribute effluent from a septic tank into the natural soil. The centerline of the tile is assumed to be at a depth of 24 inches. Only the part of the soil between depths of 24 and 60 inches is considered in making the ratings. The soil properties and site features considered are those that affect the absorption of the effluent, those that affect the construction and maintenance of the system, and those that may affect public health.

The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a

nearly level floor surrounded by cut slopes or embankments of compacted, relatively impervious soil material. Aerobic lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Relatively impervious soil material for the lagoon floor and sides is desirable to minimize seepage and contamination of local ground water.

The table "Sanitary Facilities" gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Trench sanitary landfill is an area where solid waste is disposed of by placing refuse in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil that is excavated from the trench. When the trench is full, a final cover of soil material at least 2 feet thick is placed over the landfill. Soil properties that influence the risk of pollution, the ease of excavation, trafficability, and revegetation are the major considerations in rating the soils.

Area sanitary landfill is an area where solid waste is disposed of by placing refuse in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil that is imported from a source away from the site. A final cover of soil at least 2 feet thick is placed over the completed landfill. Soil properties that influence trafficability, revegetation, and the risk of pollution are the main considerations in rating the soils for area sanitary landfills.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. The ratings in the table "Sanitary Facilities" are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste. The suitability of a soil for use as cover is based on properties that affect workability and the ease of digging, moving, and spreading the material over the refuse daily during both wet and dry periods.

Soil texture, wetness, rock fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Waste Management

Soil properties are important when organic waste is applied as fertilizer and wastewater is applied in irrigated areas. They also are important when the soil is used as a medium for the treatment and disposal of the organic waste and wastewater. Unfavorable soil properties can result in environmental damage.

The use of organic waste and wastewater as production resources results in energy and resource conservation and minimizes the problems associated with waste disposal. If disposal is the goal, applying a maximum amount of the organic waste or the wastewater to a minimal area holds costs to a minimum and environmental damage is the main hazard. If reuse is the goal, a minimum amount should be applied to a maximum area and environmental damage is unlikely.

Interpretations developed for waste management may include ratings for manure- and food-processing waste, municipal sewage sludge, use of wastewater for irrigation, and treatment of wastewater by slow rate, overland flow, and rapid infiltration processes.

Specific information regarding waste management is available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Construction Materials

The table "Construction Materials" gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In the table "Construction Materials," the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel, or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have one or more of the following characteristics: a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In the table "Construction Materials," only the probability of finding material in suitable quantity in or below the soil is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is as much as 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils generally is preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

The table "Water Management" gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In the table "Water Management," the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even more than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock. The performance of a system is affected by the depth of the root zone, the amount of salts, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff.

Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind erosion or water erosion, an

excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Building Site Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
13B:						
Zook	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
Olmitz	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Vesser	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
23C, 23C2:						
Arispe	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
24D, 24D2:						
Shelby	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
24E2, 24E3, 24F2:						
Shelby	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
51, 51+:						
Vesser	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
51B, 51B+:						
Vesser	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
54, 54+:						
Zook	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
54B:						
Zook	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
65E, 65E2, 65F, 65F2, 65G, 65G2:						
Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
93D2:						
Shelby----------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Adair-----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
94D2:						
Mystic----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
Caleb-----------	Moderate: wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
94E2:						
Mystic----------	Severe: wetness, slope.	Severe: wetness, shrink-swell, slope.	Severe: wetness, slope, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
Caleb-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
131B, 131C, 131C2:						
Pershing-------	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
131D2:						
Pershing--------	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, frost action.	Moderate: slope.
132B, 132C, 132C2:						
Weller---------	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
132D2:						
Weller----------	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, frost action.	Moderate: slope.
172:						
Wabash----------	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
179D2:						
Gara------------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
179E, 179E2, 179E3, 179F, 179F2, 179G2:						
Gara-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
192C2:						
Adair-----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
192D2:						
Adair-----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
211:						
Edina-----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
220:						
Nodaway---------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.
222C:						
Clarinda--------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
222C2, 222C3:						
Clarinda--------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
222D2:						
Clarinda--------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
223C2:						
Rinda-----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
223D2:						
Rinda-----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness, slope.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
269, 269+:						
Humeston	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
273B:						
Olmitz	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
273C:						
Olmitz	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
313D2:						
Gosport	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Moderate: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope, depth to rock.
313E2:						
Gosport	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
313F:						
Gosport	Severe: wetness, slope.	Severe: shrink-swell, slope.	Severe: slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
313F2:						
Gosport	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
362:						
Haig	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
364B:						
Grundy	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
423C2:						
Bucknell	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
423D, 423D2:						
Bucknell	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
425D, 425D2:						
Keswick	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
430:						
Ackmore	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
451D2:						
Caleb	Moderate: wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
451E2:						
Caleb	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
452C, 452C2:						
Lineville	Severe: wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
453:						
Tuskeego	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
470D2:						
Lamoni	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
Shelby	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
484:						
Lawson	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
587, 587+:						
Chequest	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Moderate: wetness, flooding.
592C2:						
Mystic	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
592D2:						
Mystic----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
711:						
Nodaway---------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.
Lawson----------	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
792C, 792C2:						
Armstrong-------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
792D, 792D2, 792D3:						
Armstrong------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
822C, 822C2:						
Lamoni----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
822D, 822D2:						
Lamoni----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
831B, 831C, 831C2:						
Pershing-------	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
894D2:						
Bucknell--------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
Gara------------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
993D2:						
Gara------------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
993D2:						
Armstrong-------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
1711:						
Nodaway---------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Severe: flooding.
Lawson----------	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Severe: flooding.
5021:						
Orthents.						
5025:						
Strip mines-----	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.
5040:						
Orthents.						

Sanitary Facilities

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
13B:					
Zook	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Olmitz	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Vesser	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
23C, 23C2:					
Arispe	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Poor: hard to pack.
24D, 24D2:					
Shelby	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
24E2, 24E3, 24F2:					
Shelby	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
51, 51+:					
Vesser	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
51B, 51B+:					
Vesser	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
54, 54+:					
Zook	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
54B:					
Zook	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
65E, 65E2, 65F, 65F2, 65G, 65G2:					
Lindley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
93D2:					
Shelby	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
93D2:					
Adair-----------	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
94D2:					
Mystic----------	Severe: wetness, percs slowly.	Severe: seepage, slope.	Severe: seepage, wetness.	Severe: wetness.	Poor: too clayey, hard to pack.
Caleb-----------	Severe: wetness.	Severe: slope, wetness.	Moderate: wetness, slope, too clayey.	Moderate: slope.	Fair: too clayey, slope, wetness.
94E2:					
Mystic----------	Severe: wetness, percs slowly, slope.	Severe: seepage, slope.	Severe: seepage, wetness, slope.	Severe: wetness, slope.	Poor: too clayey, hard to pack, slope.
Caleb-----------	Severe: wetness, slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.
131B:					
Pershing--------	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
131C, 131C2:					
Pershing--------	Severe: wetness, percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
131D2:					
Pershing--------	Severe: wetness, percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: wetness, slope.	Poor: too clayey, hard to pack.
132B:					
Weller----------	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
132C, 132C2:					
Weller----------	Severe: wetness, percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
132D2:					
Weller----------	Severe: wetness, percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: wetness, slope.	Poor: too clayey, hard to pack.
172:					
Wabash----------	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
179D2:					
Gara	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
179E, 179E2, 179E3, 179F, 179F2, 179G2:					
Gara	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
192C2, 192D2:					
Adair	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
211:					
Edina	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
220:					
Nodaway	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
222C:					
Clarinda	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
222C2, 222C3, 222D2:					
Clarinda	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
223C2, 223D2:					
Rinda	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
269, 269+:					
Humeston	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
273B:					
Olmitz	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
273C:					
Olmitz	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
313D2:					
Gosport---------	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
313E2:					
Gosport---------	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
313F:					
Gosport---------	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
313F2:					
Gosport---------	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
362:					
Haig------------	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
364B:					
Grundy----------	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
423C2, 423D, 423D2:					
Bucknell-------	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
425D, 425D2:					
Keswick---------	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
430:					
Ackmore---------	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
451D2:					
Caleb-----------	Severe: wetness.	Severe: slope, wetness.	Moderate: wetness, slope, too clayey.	Moderate: slope.	Fair: too clayey, slope, wetness.
451E2:					
Caleb-----------	Severe: wetness, slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
452C, 452C2:					
Lineville-------	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
453:					
Tuskeego--------	Severe: wetness, percs slowly.	Slight------------	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
470D2:					
Lamoni----------	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
Shelby----------	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
484:					
Lawson----------	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
587, 587+:					
Chequest--------	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
592C2, 592D2:					
Mystic----------	Severe: wetness, percs slowly.	Severe: seepage, slope.	Severe: seepage, wetness.	Severe: wetness.	Poor: too clayey, hard to pack.
711:					
Nodaway---------	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
Lawson----------	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
792C, 792C2, 792D, 792D2, 792D3:					
Armstrong------	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
822C, 822C2, 822D, 822D2:					
Lamoni---------	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
831B:					
Pershing--------	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
831C, 831C2:					
Pershing--------	Severe: wetness, percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
894D2:					
Bucknell--------	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
Gara------------	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
993D2:					
Gara------------	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Armstrong-------	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
1711:					
Nodaway---------	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
Lawson----------	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
5021: Orthents.					
5025:					
Strip mines-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
5040: Orthents.					

Construction Materials

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
13B:				
Zook------------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, thin layer.
Olmitz----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Vesser----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
23C, 23C2:				
Arispe----------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
24D:				
Shelby----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
24D2:				
Shelby----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
24E2, 24E3, 24F2:				
Shelby----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
51, 51+, 51B, 51B+:				
Vesser---------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
54, 54+:				
Zook------------	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
54B:				
Zook------------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, thin layer.
65E, 65E2, 65F, 65F2:				
Lindley--------	Fair: shrink-swell, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
65G, 65G2:				
Lindley---------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
93D2:				
Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Adair	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
94D2:				
Mystic	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Caleb	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
94E2:				
Mystic	Fair: wetness, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Caleb	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
131B, 131C, 131C2, 131D2:				
Pershing	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
132B, 132C, 132C2, 132D2:				
Weller	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
172:				
Wabash	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
179D2:				
Gara	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
179E, 179E2, 179E3, 179F, 179F2:				
Gara	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
179G2:				
Gara	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
192C2, 192D2:				
Adair	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
211: Edina	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
220: Nodaway	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
222C, 222C2, 222C3, 222D2: Clarinda	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
223C2, 223D2: Rinda	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
269, 269+: Humeston	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
273B, 273C: Olmitz	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
313D2: Gosport	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
313E2, 313F, 313F2: Gosport	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
362: Haig	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
364B: Grundy	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
423C2, 423D, 423D2: Bucknell	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
425D, 425D2: Keswick	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
430:				
Ackmore	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
451D2:				
Caleb	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
451E2:				
Caleb	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
452C, 452C2:				
Lineville	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, thin layer.
453:				
Tuskeego	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
470D2:				
Lamoni	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
484:				
Lawson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
587, 587+:				
Chequest	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
592C2, 592D2:				
Mystic	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
711:				
Nodaway	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Lawson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
792C, 792C2, 792D, 792D2, 792D3:				
Armstrong	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
822C, 822C2, 822D, 822D2:				
Lamoni---------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
831B, 831C, 831C2:				
Pershing-------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
894D2:				
Bucknell--------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Gara------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
993D2:				
Gara------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Armstrong-------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
1711:				
Nodaway---------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Lawson----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
5021: Orthents.				
5025:				
Strip mines-----	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
5040: Orthents.				

Water Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
13B:							
Zook	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Olmitz	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Slope	Favorable	Favorable.
Vesser	Moderate: seepage, slope.	Severe: wetness.	Moderate: slow refill.	Frost action, slope.	Slope, wetness.	Erodes easily, wetness.	Wetness, erodes easily.
23C, 23C2:							
Arispe	Moderate: seepage, slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.
24D:							
Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
24D2, 24E2:							
Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope	Slope.
24E3:							
Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
24F2:							
Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope	Slope.
51, 51+:							
Vesser	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
51B, 51B+:							
Vesser	Moderate: seepage, slope.	Severe: wetness.	Moderate: slow refill.	Frost action, slope.	Slope, wetness.	Erodes easily, wetness.	Wetness, erodes easily.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
54, 54+: Zook	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
54B: Zook	Moderate: slope.	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
65E, 65E2, 65F, 65F2, 65G, 65G2: Lindley	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope	Slope	Slope.
93D2: Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope	Slope.
Adair	Severe: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness.	Slope, wetness.	Wetness, slope, percs slowly.
94D2, 94E2: Mystic	Severe: seepage, slope.	Moderate: thin layer, hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
Caleb	Severe: slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope	Slope, rooting depth.
131B, 131C, 131C2: Pershing	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.
131D2: Pershing	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily, percs slowly.
132B, 132C, 132C2: Weller	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
132D2: Weller	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily, percs slowly.
172: Wabash	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding.	Wetness	Wetness, percs slowly.	Wetness, percs slowly.
179D2, 179E, 179E2: Gara	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, rooting depth.	Slope	Slope, rooting depth.
179E3: Gara	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, rooting depth, erodes easily.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
179F, 179F2, 179G2: Gara	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, rooting depth.	Slope	Slope, rooting depth.
192C2: Adair	Moderate: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness.	Wetness	Wetness, percs slowly.
192D2: Adair	Severe: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness.	Slope, wetness.	Wetness, slope, percs slowly.
211: Edina	Slight	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
220: Nodaway	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Flooding	Erodes easily	Erodes easily.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
222C, 222C2: Clarinda--------	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
222C3: Clarinda--------	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness.	Erodes easily, wetness.	Wetness, erodes easily.
222D2: Clarinda--------	Severe: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
223C2: Rinda-----------	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
223D2: Rinda-----------	Severe: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
269, 269+: Humeston--------	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
273B, 273C: Olmitz----------	Moderate: seepage, slope.	Slight---------	Severe: no water.	Deep to water	Slope----------	Favorable------	Favorable.
313D2, 313E2: Gosport---------	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Slope, percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
313F: Gosport---------	Severe: slope.	Slight---------	Severe: no water.	Percs slowly, depth to rock, slope.	Slope, wetness, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
313F2: Gosport	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
362: Haig	Slight	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
364B: Grundy	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Wetness, erodes easily.
423C2: Bucknell	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
423D, 423D2: Bucknell	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
425D, 425D2: Keswick	Severe: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
430: Ackmore	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
451D2, 451E2: Caleb	Severe: slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope	Slope, rooting depth.
452C, 452C2: Lineville	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
453: Tuskeego	Slight	Severe: wetness.	Severe: slow refill.	Percs slowly	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
470D2:							
Lamoni	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope	Slope.
484:							
Lawson	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
587:							
Chequest	Slight	Severe: wetness.	Severe: slow refill.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
587+:							
Chequest	Slight	Severe: wetness.	Severe: slow refill.	Flooding, frost action.	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
592C2:							
Mystic	Severe: seepage.	Moderate: thin layer, hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
592D2:							
Mystic	Severe: seepage, slope.	Moderate: thin layer, hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
711:							
Nodaway	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Flooding	Erodes easily	Erodes easily.
Lawson	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
792C, 792C2:							
Armstrong	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
792D, 792D2:							
Armstrong-------	Severe: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, wetness, percs slowly.	Wetness, slope, percs slowly.
792D3:							
Armstrong-------	Severe: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
822C, 822C2:							
Lamoni----------	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
822D, 822D2:							
Lamoni----------	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
831B, 831C, 831C2:							
Pershing-------	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.
894D2:							
Bucknell--------	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
Gara------------	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Slope, rooting depth.	Slope----------	Slope, rooting depth.
993D2:							
Gara------------	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Slope, rooting depth.	Slope----------	Slope, rooting depth.
Armstrong-------	Severe: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, wetness, percs slowly.	Wetness, slope, percs slowly.
1711:							
Nodaway---------	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Flooding-------	Erodes easily	Erodes easily.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
1711:							
Lawson----------	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
5021:							
Orthents.							
5025:							
Strip mines-----	Severe: depth to rock, slope.	Slight---------	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
5040:							
Orthents.							

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features listed in tables are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

The table "Engineering Index Properties" gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the series descriptions in Part I of this survey.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (ASTM, 1993) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

The tables "Physical Properties of the Soils" and "Chemical Properties of the Soils" show estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the series descriptions in Part I of this survey.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. The estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $^1/_3$-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In the table "Physical Properties of the Soils," the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent;

moderate, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, more than 9 percent, is sometimes used.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In the table "Physical Properties of the Soils," the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (as much as 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils generally are not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams that have more than 5 percent finely divided calcium carbonate. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils have less than 5 percent finely divided calcium carbonate. They are moderately erodible. Crops can be grown if measures to control wind erosion are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils have less than 5 percent finely divided calcium carbonate. They are moderately erodible. Crops can be grown if ordinary measures to control wind erosion are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils have less than 5 percent finely divided calcium carbonate. They are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

8. Soils that are not subject to wind erosion because of rock fragments on the surface or because of surface wetness.

The *wind erodibility index* is determined based on the percentage of dry, nonerodible surface soil aggregates larger than 0.84 millimeter in diameter. It is an expression of the stability of the soil aggregates, or the extent to which they are broken down by tillage and the abrasion caused by windblown soil particles.

In the table "Chemical Properties of the Soils," *cation-exchange capacity* is the total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. It is a measurement of the nutrient-holding capacity of the soil.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate is expressed as a weighted

percentage of the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients, such as phosphorus, is affected by the amount of carbonates in the soil.

Water Features

The table "Water Features" gives estimates of several important water features used in land use planning that involves engineering considerations. These features are described in the following paragraphs.

Hydrologic soil groups are groups of soils that, when saturated, have the same runoff potential under similar storm and ground cover conditions. The soil properties that affect the runoff potential are those that influence the minimum rate of infiltration in a bare soil after prolonged wetting and when the soil is not frozen. These properties include the depth to a seasonal high water table, the intake rate, permeability after prolonged wetting, and the depth to a very slowly permeable layer. The influences of ground cover and slope are treated independently and are not taken into account in hydrologic soil groups.

In the definitions of the hydrologic soil groups, the infiltration rate is the rate at which water enters the soil at the surface and is controlled by surface conditions. The transmission rate is the rate at which water moves through the soil and is controlled by properties of the soil layers.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of very deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well or well drained soils that have a moderately fine to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils that have a moderately fine or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clayey soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in the table, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflow from streams or by runoff from adjacent slopes. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in marshes and swamps or in closed depressions is considered to be ponding.

The table "Water Features" gives the frequency and duration of flooding and the time of year when flooding is most likely to occur. Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as none, rare, occasional, or frequent. *None* means flooding is not probable; *rare* that it is unlikely but is possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is 50 percent in any year).

Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 to 30 days), and *very long* (more than 30 days). The time of year that flooding is most likely to occur is expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and level of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is a zone of saturation at the highest average depth during the wettest season. It is at least 6 inches thick, persists in the soil for more than a few weeks, and is within 6 feet of the surface. Indicated in the table "Water Features" are the depth to the seasonal high water table, the kind of water table, and the months of the year when the water table usually is highest.

An *apparent* water table is indicated by the level at

which water stands in a freshly dug, unlined borehole after adequate time for adjustments in the surrounding soil.

A *perched* water table is one that is above an unsaturated zone in the soil. The basis for determining that a water table is perched may be general knowledge of the area. The water table is proven to be perched if the water level in a borehole is observed to fall when the borehole is extended.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Soil Features

The table "Soil Features" gives estimates of several important soil features used in land use planning that involves engineering considerations. These features are described in the following paragraphs.

Depth to bedrock is given if bedrock is within a depth of 60 inches. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

A *low* potential for frost action indicates that the soil is rarely susceptible to the formation of ice lenses; a *moderate* potential indicates that the soil is susceptible to formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength; and a *high* potential indicates that the soil is highly susceptible to formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate content, texture, moisture content, and acidity of the soil.

Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Properties

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
13B:												
Zook------------	0-7	Silty clay loam	CH, CL	A-7	0	0	100	100	95-100	95-100	45-65	20-35
	7-60	Silty clay, silty clay loam.	CH	A-7	0	0	100	100	95-100	95-100	60-85	35-55
Olmitz----------	0-8	Loam-----------	CL	A-6	0	0	100	90-100	85-95	60-80	30-40	11-20
	8-38	Loam, clay loam	CL	A-6	0	0	100	90-100	85-95	60-80	30-40	11-20
	38-60	Clay loam------	CL	A-6, A-7	0	0	100	90-100	85-95	60-80	35-45	15-25
Vesser----------	0-14	Silt loam------	CL	A-6	0	0	100	100	98-100	95-100	30-40	10-20
	14-33	Silt loam------	CL	A-6	0	0	100	100	98-100	95-100	30-40	10-20
	33-60	Silty clay loam	CL	A-7	0	0	100	100	98-100	95-100	40-50	15-25
23C:												
Arispe----------	0-10	Silty clay loam	CL, CH	A-7	0	0	100	100	100	95-100	40-55	20-30
	10-22	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	45-60	25-35
	22-43	Silty clay loam	CL, CH	A-7	0	0	100	100	100	95-100	40-55	20-30
	43-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	0	100	100	100	95-100	35-50	20-30
23C2:												
Arispe----------	0-6	Silty clay loam	CL, CH	A-7	0	0	100	100	100	95-100	40-55	20-30
	6-22	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	45-60	25-35
	22-43	Silty clay loam	CL, CH	A-7	0	0	100	100	100	95-100	40-55	20-30
	43-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	0	100	100	100	95-100	35-50	20-30
24D:												
Shelby----------	0-11	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	75-90	55-70	35-45	15-25
	11-56	Clay loam------	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	56-60	Clay loam------	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
24D2:												
Shelby----------	0-6	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	75-90	55-70	35-45	15-25
	6-15	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	75-90	55-70	35-45	15-25
	15-50	Clay loam------	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	50-60	Clay loam------	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct	Pct					Pct	
24E2:												
Shelby----------	0-6	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	75-90	55-70	35-45	15-25
	6-15	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	75-90	55-70	35-45	15-25
	15-50	Clay loam------	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	50-60	Clay loam------	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
24E3:												
Shelby----------	0-6	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	75-90	55-70	35-45	15-25
	6-50	Clay loam------	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	50-60	Clay loam------	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
24F2:												
Shelby----------	0-6	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	75-90	55-70	35-45	15-25
	6-15	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	75-90	55-70	35-45	15-25
	15-50	Clay loam------	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	50-60	Clay loam------	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
51:												
Vesser----------	0-14	Silt loam------	CL	A-6	0	0	100	100	98-100	95-100	30-40	10-20
	14-33	Silt loam------	CL	A-6	0	0	100	100	98-100	95-100	30-40	10-20
	33-60	Silty clay loam	CL	A-7	0	0	100	100	98-100	95-100	40-50	15-25
51+:												
Vesser----------	0-14	Silt loam------	CL	A-6	0	0	100	100	98-100	95-100	30-40	10-20
	14-33	Silt loam------	CL	A-6	0	0	100	100	98-100	95-100	30-40	10-20
	33-60	Silty clay loam	CL	A-7	0	0	100	100	98-100	95-100	40-50	15-25
51B:												
Vesser----------	0-14	Silt loam------	CL	A-6	0	0	100	100	98-100	95-100	30-40	10-20
	14-33	Silt loam------	CL	A-6	0	0	100	100	98-100	95-100	30-40	10-20
	33-60	Silty clay loam	CL	A-7	0	0	100	100	98-100	95-100	40-50	15-25
51B+:												
Vesser----------	0-14	Silt loam------	CL	A-6	0	0	100	100	98-100	95-100	30-40	10-20
	14-33	Silt loam------	CL	A-6	0	0	100	100	98-100	95-100	30-40	10-20
	33-60	Silty clay loam	CL	A-7	0	0	100	100	98-100	95-100	40-50	15-25
54:												
Zook------------	0-7	Silty clay loam	CH, CL	A-7	0	0	100	100	95-100	95-100	45-65	20-35
	7-37	Silty clay, silty clay loam.	CH	A-7	0	0	100	100	95-100	95-100	60-85	35-55
	37-60	Silty clay loam, silty clay, silt loam.	CH, CL, ML, MH	A-7, A-6	0	0	100	100	95-100	95-100	35-80	10-50

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
54+:												
Zook------------	0-12	Silt loam------	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	95-100	25-40	5-15
	12-42	Silty clay, silty clay loam.	CH	A-7	0	0	100	100	95-100	95-100	60-85	35-55
	42-60	Silty clay loam, silty clay, silt loam.	CH, CL, ML, MH	A-7, A-6	0	0	100	100	95-100	95-100	35-80	10-50
54B:												
Zook------------	0-7	Silty clay loam	CH, CL	A-7	0	0	100	100	95-100	95-100	45-65	20-35
	7-60	Silty clay, silty clay loam.	CH	A-7	0	0	100	100	95-100	95-100	60-85	35-55
65E:												
Lindley---------	0-7	Loam-----------	CL	A-6	0	0	95-100	90-100	85-95	50-65	25-35	10-15
	7-41	Clay loam, loam	CL	A-6, A-7	0	0	95-100	90-100	85-95	55-75	30-45	12-20
	41-60	Loam, clay loam	CL	A-6	0	0	95-100	90-100	85-95	50-70	25-35	10-15
65E2:												
Lindley---------	0-5	Loam-----------	CL	A-6	0	0	95-100	90-100	85-95	50-65	25-35	10-15
	5-39	Clay loam, loam	CL	A-6, A-7	0	0	95-100	90-100	85-95	55-75	30-45	12-20
	39-60	Loam, clay loam	CL	A-6	0	0	95-100	90-100	85-95	50-70	25-35	10-15
65F:												
Lindley---------	0-7	Loam-----------	CL	A-6	0	0	95-100	90-100	85-95	50-65	25-35	10-15
	7-41	Clay loam, loam	CL	A-6, A-7	0	0	95-100	90-100	85-95	55-75	30-45	12-20
	41-60	Loam, clay loam	CL	A-6	0	0	95-100	90-100	85-95	50-70	25-35	10-15
65F2:												
Lindley---------	0-5	Loam-----------	CL	A-6	0	0	95-100	90-100	85-95	50-65	25-35	10-15
	5-39	Clay loam, loam	CL	A-6, A-7	0	0	95-100	90-100	85-95	55-75	30-45	12-20
	39-60	Loam, clay loam	CL	A-6	0	0	95-100	90-100	85-95	50-70	25-35	10-15
65G:												
Lindley---------	0-7	Loam-----------	CL	A-6	0	0	95-100	90-100	85-95	50-65	25-35	10-15
	7-41	Clay loam, loam	CL	A-6, A-7	0	0	95-100	90-100	85-95	55-75	30-45	12-20
	41-60	Loam, clay loam	CL	A-6	0	0	95-100	90-100	85-95	50-70	25-35	10-15
65G2:												
Lindley---------	0-5	Loam-----------	CL	A-6	0	0	95-100	90-100	85-95	50-65	25-35	10-15
	5-39	Clay loam, loam	CL	A-6, A-7	0	0	95-100	90-100	85-95	55-75	30-45	12-20
	39-60	Loam, clay loam	CL	A-6	0	0	95-100	90-100	85-95	50-70	25-35	10-15

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
93D2:												
Shelby-----------	0-6	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	75-90	55-70	35-45	15-25
	6-15	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	75-90	55-70	35-45	15-25
	15-50	Clay loam------	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	50-60	Clay loam------	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
Adair------------	0-6	Clay loam------	CL	A-6	0	0	95-100	80-95	75-90	60-80	30-40	10-20
	6-29	Silty clay, clay, clay loam.	CL, CH	A-7	0	0	95-100	80-95	70-90	55-80	40-55	20-30
	29-60	Clay loam------	CL	A-6, A-7	0	0	95-100	80-95	70-90	55-80	35-50	15-25
94D2:												
Mystic-----------	0-9	Clay loam------	CL	A-6, A-7	0	0	100	100	80-100	65-90	30-45	10-25
	9-51	Clay loam, clay, silty clay.	CL, CH	A-7	0	0	100	90-100	80-100	65-80	40-55	25-35
	51-60	Sandy clay loam, loam.	SC, CL, SC-SM, CL-ML	A-6, A-4	0	0-5	90-100	80-100	70-95	40-65	25-40	5-20
Caleb------------	0-7	Loam-----------	CL	A-6	0	0	95-100	85-100	70-90	60-80	30-40	10-20
	7-43	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	0	90-100	85-100	60-80	50-75	35-45	15-25
	43-60	Sandy clay loam, sandy loam, clay loam.	SC, CL, SC-SM, CL-ML	A-6, A-4	0	0	95-100	85-100	70-90	35-80	20-40	5-20
94E2:												
Mystic-----------	0-9	Clay loam------	CL	A-6, A-7	0	0	100	100	80-100	65-90	30-45	10-25
	9-51	Clay loam, clay, silty clay.	CL, CH	A-7	0	0	100	90-100	80-100	65-80	40-55	25-35
	51-60	Sandy clay loam, loam.	SC, CL, SC-SM, CL-ML	A-6, A-4	0	0-5	90-100	80-100	70-95	40-65	25-40	5-20
Caleb------------	0-7	Loam-----------	CL	A-6	0	0	95-100	85-100	70-90	60-80	30-40	10-20
	7-43	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	0	90-100	85-100	60-80	50-75	35-45	15-25
	43-60	Sandy clay loam, sandy loam, clay loam.	SC, CL, SC-SM, CL-ML	A-6, A-4	0	0	95-100	85-100	70-90	35-80	20-40	5-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
131B:												
Pershing--------	0-11	Silt loam------	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
	11-15	Silty clay loam	CL, CH	A-7	0	0	100	100	100	95-100	40-55	15-30
	15-34	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	40-65	20-40
	34-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	100	95-100	35-55	20-35
131C:												
Pershing--------	0-11	Silt loam------	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
	11-15	Silty clay loam	CL, CH	A-7	0	0	100	100	100	95-100	40-55	15-30
	15-34	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	40-65	20-40
	34-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	100	95-100	35-55	20-35
131C2:												
Pershing--------	0-6	Silty clay loam	CL, CH	A-7	0	0	100	100	100	95-100	40-55	15-30
	6-9	Silty clay loam	CL, CH	A-7	0	0	100	100	100	95-100	40-55	15-30
	9-34	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	40-65	20-40
	34-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	100	95-100	35-55	20-35
131D2:												
Pershing--------	0-6	Silty clay loam	CL, CH	A-7	0	0	100	100	100	95-100	40-55	15-30
	6-9	Silty clay loam	CL, CH	A-7	0	0	100	100	100	95-100	40-55	15-30
	9-34	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	40-65	20-40
	34-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	100	95-100	35-55	20-35
132B:												
Weller----------	0-12	Silt loam------	CL, CL-ML	A-6, A-4	0	0	100	100	100	95-100	25-40	5-15
	12-43	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	45-65	30-40
	43-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	100	95-100	30-55	10-30

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
132C:												
Weller----------	0-12	Silt loam------	CL, CL-ML	A-6, A-4	0	0	100	100	100	95-100	25-40	5-15
	12-43	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	45-65	30-40
	43-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	100	95-100	30-55	10-30
132C2:												
Weller----------	0-6	Silty clay loam	CL, CH	A-7	0	0	100	100	100	95-100	40-55	25-35
	6-37	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	45-65	30-40
	37-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	100	95-100	30-55	10-30
132D2:												
Weller----------	0-6	Silty clay loam	CL, CH	A-7	0	0	100	100	100	95-100	40-55	25-35
	6-37	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	45-65	30-40
	37-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	100	95-100	30-55	10-30
172:												
Wabash----------	0-8	Silty clay loam	CL, CH	A-6, A-7	0	0	100	100	100	95-100	35-55	15-35
	8-60	Silty clay, clay.	CH	A-7	0	0	100	100	100	95-100	52-78	30-55
179D2:												
Gara------------	0-7	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	70-85	55-75	35-45	15-25
	7-47	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	47-60	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
179E:												
Gara------------	0-9	Loam-----------	CL, CL-ML	A-4, A-6	0	0	95-100	85-95	75-85	55-70	20-30	5-15
	9-47	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	47-60	Loam, clay loam	CL	A-6, A-7	0	0-5	90-95	85-95	70-85	55-75	35-45	15-25
179E2:												
Gara------------	0-7	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	70-85	55-75	35-45	15-25
	7-47	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	47-60	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
179E3:												
Gara------------	0-7	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	70-85	55-75	35-45	15-25
	7-47	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	47-60	Loam, clay loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
179F:												
Gara------------	0-9	Loam-----------	CL, CL-ML	A-4, A-6	0	0	95-100	85-95	75-85	55-70	20-30	5-15
	9-47	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	47-60	Loam, clay loam	CL	A-6, A-7	0	0-5	90-95	85-95	70-85	55-75	35-45	15-25
179F2:												
Gara------------	0-7	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	70-85	55-75	35-45	15-25
	7-47	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	47-60	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
179G2:												
Gara------------	0-7	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	70-85	55-75	35-45	15-25
	7-47	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	47-60	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
192C2:												
Adair-----------	0-6	Clay loam------	CL	A-6	0	0	95-100	80-95	75-90	60-80	30-40	10-20
	6-29	Silty clay, clay, clay loam.	CL, CH	A-7	0	0	95-100	80-95	70-90	55-80	40-55	20-30
	29-60	Clay loam------	CL	A-6, A-7	0	0	95-100	80-95	70-90	55-80	35-50	15-25
192D2:												
Adair-----------	0-6	Clay loam------	CL	A-6	0	0	95-100	80-95	75-90	60-80	30-40	10-20
	6-29	Silty clay, clay, clay loam.	CL, CH	A-7	0	0	95-100	80-95	70-90	55-80	40-55	20-30
	29-60	Clay loam------	CL	A-6, A-7	0	0	95-100	80-95	70-90	55-80	35-50	15-25
211:												
Edina-----------	0-9	Silt loam------	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	85-100	25-40	5-15
	9-16	Silt loam------	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	85-100	25-40	5-15
	16-43	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	90-100	55-75	30-45
	43-60	Silty clay loam	CL, CH	A-6, A-7	0	0	100	100	95-100	90-100	35-60	15-35
220:												
Nodaway---------	0-8	Silt loam------	CL, CL-ML	A-4, A-6	0	0	100	95-100	95-100	90-100	25-35	5-15
	8-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	0	100	95-100	95-100	90-100	25-40	5-15

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
222C:												
Clarinda--------	0-14	Silty clay loam	CL	A-7	0	0	100	95-100	90-100	85-100	40-50	20-30
	14-45	Silty clay, clay.	CH	A-7	0	0	100	95-100	85-100	80-100	55-70	30-40
	45-60	Clay, silty clay.	CH	A-7	0	0	95-100	95-100	80-95	75-90	55-70	35-45
222C2:												
Clarinda--------	0-6	Silty clay loam	CL	A-7	0	0	100	95-100	90-100	85-100	40-50	20-30
	6-39	Silty clay, clay.	CH	A-7	0	0	100	95-100	85-100	80-100	55-70	30-40
	39-60	Clay, silty clay.	CH	A-7	0	0	95-100	95-100	80-95	75-90	55-70	35-45
222C3:												
Clarinda--------	0-6	Silty clay loam	CL	A-7	0	0	100	95-100	90-100	85-100	40-50	20-30
	6-39	Silty clay, clay.	CH	A-7	0	0	100	95-100	85-100	80-100	55-70	30-40
	39-60	Clay, silty clay.	CH	A-7	0	0	95-100	95-100	80-95	75-90	55-70	35-45
222D2:												
Clarinda--------	0-6	Silty clay loam	CL	A-7	0	0	100	95-100	90-100	85-100	40-50	20-30
	6-39	Silty clay, clay.	CH	A-7	0	0	100	95-100	85-100	80-100	55-70	30-40
	39-60	Clay, silty clay.	CH	A-7	0	0	95-100	95-100	80-95	75-90	55-70	35-45
223C2:												
Rinda-----------	0-7	Silty clay loam	CL	A-7	0	0	100	95-100	90-100	85-100	40-50	20-30
	7-11	Silty clay loam	CH	A-7	0	0	100	95-100	90-100	85-100	45-55	20-30
	11-60	Clay, silty clay.	CH, CL	A-7	0	0	95-100	95-100	80-95	75-90	55-70	35-45
223D2:												
Rinda-----------	0-7	Silty clay loam	CL	A-7	0	0	100	95-100	90-100	85-100	40-50	20-30
	7-11	Silty clay loam	CH	A-7	0	0	100	95-100	90-100	85-100	45-55	20-30
	11-60	Clay, silty clay.	CH, CL	A-7	0	0	95-100	95-100	80-95	75-90	55-70	35-45
269:												
Humeston--------	0-14	Silty clay loam	CL	A-6	0	0	100	100	95-100	95-100	30-40	10-20
	14-24	Silt loam------	CL, CL-ML	A-6, A-4	0	0	100	100	95-100	95-100	25-40	5-15
	24-60	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	95-100	95-100	45-55	25-35

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
269+:												
Humeston----------	0-14	Silt loam-------	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	95-100	25-40	5-15
	14-24	Silt loam-------	CL, CL-ML	A-6, A-4	0	0	100	100	95-100	95-100	25-40	5-15
	24-60	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	95-100	95-100	45-55	25-35
273B:												
Olmitz-----------	0-9	Loam------------	CL	A-6	0	0	100	90-100	85-95	60-80	30-40	11-20
	9-28	Loam, clay loam	CL	A-6	0	0	100	90-100	85-95	60-80	30-40	11-20
	28-60	Clay loam-------	CL	A-6, A-7	0	0	100	90-100	85-95	60-80	35-45	15-25
273C:												
Olmitz-----------	0-9	Loam------------	CL	A-6	0	0	100	90-100	85-95	60-80	30-40	11-20
	9-28	Loam, clay loam	CL	A-6	0	0	100	90-100	85-95	60-80	30-40	11-20
	28-60	Clay loam-------	CL	A-6, A-7	0	0	100	90-100	85-95	60-80	35-45	15-25
313D2:												
Gosport----------	0-6	Silty clay loam	ML, MH	A-7	0	0	100	90-100	90-100	85-100	41-55	11-20
	6-36	Clay, silty clay, silty clay loam.	CH	A-7	0	0	100	90-100	90-100	85-100	50-65	35-50
	36-60	Weathered bedrock.	---	---	0	0	0	0	0	0	---	NP
313E2:												
Gosport----------	0-6	Silty clay loam	ML, MH	A-7	0	0	100	90-100	90-100	85-100	41-55	11-20
	6-36	Clay, silty clay, silty clay loam.	CH	A-7	0	0	100	90-100	90-100	85-100	50-65	35-50
	36-60	Weathered bedrock.	---	---	0	0	0	0	0	0	---	NP
313F:												
Gosport----------	0-9	Silty clay loam	ML, MH	A-7	0	0	100	90-100	90-100	85-100	41-55	11-20
	9-39	Clay, silty clay, silty clay loam.	CH	A-7	0	0	100	90-100	90-100	85-100	50-65	35-50
	39-60	Weathered bedrock.	---	---	0	0	0	0	0	0	---	NP
313F2:												
Gosport----------	0-6	Silty clay loam	ML, MH	A-7	0	0	100	90-100	90-100	85-100	41-55	11-20
	6-36	Clay, silty clay, silty clay loam.	CH	A-7	0	0	100	90-100	90-100	85-100	50-65	35-50
	36-60	Weathered bedrock.	---	---	0	0	0	0	0	0	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
362:												
Haig------------	0-7	Silt loam------	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25
	7-21	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	100	95-100	40-55	20-30
	21-51	Silty clay	CH	A-7	0	0	100	100	100	95-100	50-65	30-40
	51-60	Silty clay loam	CL, CH	A-7, A-6	0	0	100	100	100	95-100	35-55	20-30
364B:												
Grundy----------	0-12	Silty clay loam	CH, CL	A-7	0	0	100	100	95-100	90-100	40-55	20-35
	12-15	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	95-100	90-100	45-55	25-35
	15-35	Silty clay-----	CH	A-7	0	0	100	100	95-100	90-100	50-70	30-45
	35-60	Silty clay loam	CH, CL	A-7	0	0	100	100	90-100	90-100	40-55	25-35
423C2:												
Bucknell--------	0-7	Silty clay loam	CL	A-6, A-7	0	0	95-100	95-100	80-95	70-95	35-45	15-25
	7-49	Clay, clay loam	CH	A-7	0	0	95-100	95-100	90-100	85-100	50-60	25-35
	49-60	Clay loam------	CL	A-6, A-7	0	0	95-100	95-100	70-90	55-85	35-50	15-30
423D:												
Bucknell--------	0-14	Silty clay loam	CL	A-6, A-7	0	0	95-100	95-100	80-95	70-95	35-45	15-25
	14-54	Clay, clay loam	CH	A-7	0	0	95-100	95-100	90-100	85-100	50-60	25-35
	54-60	Clay loam------	CL	A-6, A-7	0	0	95-100	95-100	70-90	55-85	35-50	15-30
423D2:												
Bucknell--------	0-7	Silty clay loam	CL	A-6, A-7	0	0	95-100	95-100	80-95	70-95	35-45	15-25
	7-49	Clay, clay loam	CH	A-7	0	0	95-100	95-100	90-100	85-100	50-60	25-35
	49-60	Clay loam------	CL	A-6, A-7	0	0	95-100	95-100	70-90	55-85	35-50	15-30
425D:												
Keswick---------	0-6	Loam-----------	CL, CL-ML	A-6, A-4	0	0-5	90-100	80-100	75-90	60-80	20-30	5-15
	6-29	Clay loam, clay	CH, CL	A-7	0	0-5	90-100	80-100	70-90	55-80	40-70	20-40
	29-60	Clay loam------	CL	A-6	0	0-5	90-100	80-100	70-90	55-80	30-40	15-25
425D2:												
Keswick---------	0-5	Clay loam------	CL	A-6, A-7	0	0-5	90-100	80-100	75-90	60-80	35-50	15-25
	5-24	Clay loam, clay	CH, CL	A-7	0	0-5	90-100	80-100	70-90	55-80	40-70	20-40
	24-60	Clay loam------	CL	A-6	0	0-5	90-100	80-100	70-90	55-80	30-40	15-25

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
430:												
Ackmore---------	0-8	Silt loam------	CL, ML	A-4, A-6, A-7	0	0	100	100	95-100	85-100	25-50	8-20
	8-28	Silt loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	0	100	100	95-100	85-100	25-50	8-20
	28-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	95-100	85-100	35-60	15-30
451D2:												
Caleb-----------	0-7	Loam-----------	CL	A-6	0	0	95-100	85-100	70-90	60-80	30-40	10-20
	7-43	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	0	90-100	85-100	60-80	50-75	35-45	15-25
	43-60	Sandy clay loam, sandy loam, clay loam.	SC, CL, SC-SM, CL-ML	A-6, A-4	0	0	95-100	85-100	70-90	35-80	20-40	5-20
451E2:												
Caleb-----------	0-7	Loam-----------	CL	A-6	0	0	95-100	85-100	70-90	60-80	30-40	10-20
	7-43	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	0	90-100	85-100	60-80	50-75	35-45	15-25
	43-60	Sandy clay loam, sandy loam, clay loam.	SC, CL, SC-SM, CL-ML	A-6, A-4	0	0	95-100	85-100	70-90	35-80	20-40	5-20
452C:												
Lineville-------	0-11	Silt loam------	CL, ML	A-6, A-7	0	0	100	100	95-100	95-100	35-45	10-20
	11-19	Silty clay loam	CL, CH	A-7	0	0	100	100	95-100	95-100	45-55	25-35
	19-29	Clay loam, loam	CL	A-6, A-7	0	0	95-100	80-100	75-95	65-90	35-50	20-35
	29-60	Clay loam, clay	CH, CL	A-7	0	0-5	95-100	80-100	70-90	55-80	45-60	25-35
452C2:												
Lineville-------	0-6	Silt loam------	CL, ML	A-6, A-7	0	0	100	100	95-100	95-100	35-45	10-20
	6-19	Silty clay loam	CL, CH	A-7	0	0	100	100	95-100	95-100	45-55	25-35
	19-33	Clay loam, loam	CL	A-6, A-7	0	0	95-100	80-100	75-95	65-90	35-50	20-35
	33-60	Clay loam, clay	CH, CL	A-7	0	0-5	95-100	80-100	70-90	55-80	45-60	25-35

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
453:												
Tuskeego--------	0-20	Silt loam------	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	95-100	25-35	5-15
	20-32	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	95-100	95-100	30-35	11-15
	32-60	Silty clay loam, silty clay.	CH	A-7	0	0	100	100	95-100	95-100	50-60	25-35
470D2:												
Lamoni----------	0-6	Silty clay loam	CL	A-6, A-7	0	0	95-100	95-100	80-95	70-95	35-45	15-25
	6-34	Clay loam, clay	CH	A-7	0	0	95-100	95-100	90-100	85-100	50-60	25-35
	34-60	Clay loam------	CL	A-6, A-7	0	0	95-100	95-100	70-90	55-85	35-50	15-30
Shelby----------	0-6	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	75-90	55-70	35-45	15-25
	6-15	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	75-90	55-70	35-45	15-25
	15-50	Clay loam------	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	50-60	Clay loam------	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
484:												
Lawson----------	0-9	Silt loam------	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	85-100	20-40	5-20
	9-34	Silt loam, silty clay loam.	CL, CL-ML	A-4	0	0	100	100	90-100	85-100	20-30	5-10
	34-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	90-100	60-100	20-45	10-25
587:												
Chequest--------	0-12	Silty clay loam	CL	A-7	0	0	100	100	95-100	95-100	40-50	15-25
	12-60	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	95-100	90-100	45-60	20-30
587+:												
Chequest--------	0-15	Silt loam------	CL	A-6	0	0	100	100	90-100	85-100	30-40	10-20
	15-60	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	95-100	90-100	45-60	20-30
592C2:												
Mystic----------	0-9	Clay loam------	CL	A-6, A-7	0	0	100	100	80-100	65-90	30-45	10-25
	9-51	Clay loam, clay, silty clay.	CL, CH	A-7	0	0	100	90-100	80-100	65-80	40-55	25-35
	51-60	Sandy clay loam, loam.	SC, CL, SC-SM, CL-ML	A-6, A-4	0	0-5	90-100	80-100	70-95	40-65	25-40	5-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
592D2:												
Mystic----------	0-9	Clay loam------	CL	A-6, A-7	0	0	100	100	80-100	65-90	30-45	10-25
	9-51	Clay loam, clay, silty clay.	CL, CH	A-7	0	0	100	90-100	80-100	65-80	40-55	25-35
	51-60	Sandy clay loam, loam.	SC, CL, SC-SM, CL-ML	A-6, A-4	0	0-5	90-100	80-100	70-95	40-65	25-40	5-20
711:												
Nodaway---------	0-8	Silt loam------	CL, CL-ML	A-4, A-6	0	0	100	95-100	95-100	90-100	25-35	5-15
	8-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	0	100	95-100	95-100	90-100	25-40	5-15
Lawson----------	0-9	Silt loam------	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	85-100	20-40	5-20
	9-34	Silt loam, silty clay loam.	CL, CL-ML	A-4	0	0	100	100	90-100	85-100	20-30	5-10
	34-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	90-100	60-100	20-45	10-25
792C:												
Armstrong-------	0-11	Loam-----------	CL, CL-ML	A-6, A-4	0	0-5	90-100	80-95	75-90	55-80	20-30	5-15
	11-40	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	40-60	Clay loam------	CL	A-6	0	0-5	90-100	80-95	70-90	55-80	30-40	15-20
792C2:												
Armstrong-------	0-6	Clay loam------	CL	A-6, A-7	0	0-5	90-100	80-95	75-90	55-80	35-45	15-25
	6-34	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	34-60	Clay loam------	CL	A-6	0	0-5	90-100	80-95	70-90	55-80	30-40	15-20
792D:												
Armstrong-------	0-11	Loam-----------	CL, CL-ML	A-6, A-4	0	0-5	90-100	80-95	75-90	55-80	20-30	5-15
	11-40	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	40-60	Clay loam------	CL	A-6	0	0-5	90-100	80-95	70-90	55-80	30-40	15-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
792D2:												
Armstrong-------	0-6	Clay loam------	CL	A-6, A-7	0	0-5	90-100	80-95	75-90	55-80	35-45	15-25
	6-34	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	34-60	Clay loam------	CL	A-6	0	0-5	90-100	80-95	70-90	55-80	30-40	15-20
792D3:												
Armstrong-------	0-6	Clay loam------	CL	A-6, A-7	0	0-5	90-100	80-95	75-90	55-80	35-45	15-25
	6-34	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	34-60	Clay loam------	CL	A-6	0	0-5	90-100	80-95	70-90	55-80	30-40	15-20
822C:												
Lamoni----------	0-14	Silty clay loam	CL	A-6, A-7	0	0	95-100	95-100	80-95	70-95	35-45	15-25
	14-42	Clay loam, clay	CH	A-7	0	0	95-100	95-100	90-100	85-100	50-60	25-35
	42-60	Clay loam------	CL	A-6, A-7	0	0	95-100	95-100	70-90	55-85	35-50	15-30
822C2:												
Lamoni----------	0-6	Silty clay loam	CL	A-6, A-7	0	0	95-100	95-100	80-95	70-95	35-45	15-25
	6-34	Clay loam, clay	CH	A-7	0	0	95-100	95-100	90-100	85-100	50-60	25-35
	34-60	Clay loam------	CL	A-6, A-7	0	0	95-100	95-100	70-90	55-85	35-50	15-30
822D:												
Lamoni----------	0-14	Silty clay loam	CL	A-6, A-7	0	0	95-100	95-100	80-95	70-95	35-45	15-25
	14-42	Clay loam, clay	CH	A-7	0	0	95-100	95-100	90-100	85-100	50-60	25-35
	42-60	Clay loam------	CL	A-6, A-7	0	0	95-100	95-100	70-90	55-85	35-50	15-30
822D2:												
Lamoni----------	0-6	Silty clay loam	CL	A-6, A-7	0	0	95-100	95-100	80-95	70-95	35-45	15-25
	6-34	Clay loam, clay	CH	A-7	0	0	95-100	95-100	90-100	85-100	50-60	25-35
	34-60	Clay loam------	CL	A-6, A-7	0	0	95-100	95-100	70-90	55-85	35-50	15-30
831B:												
Pershing--------	0-11	Silt loam------	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
	11-15	Silty clay loam	CL, CH	A-7	0	0	100	100	100	95-100	40-55	15-30
	15-34	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	40-65	20-40
	34-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	100	95-100	35-55	20-35

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
831C:												
Pershing--------	0-11	Silt loam------	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
	11-15	Silty clay loam	CL, CH	A-7	0	0	100	100	100	95-100	40-55	15-30
	15-34	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	40-65	20-40
	34-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	100	95-100	35-55	20-35
831C2:												
Pershing--------	0-6	Silty clay loam	CL, CH	A-7	0	0	100	100	100	95-100	40-55	15-30
	6-10	Silty clay loam	CL, CH	A-7	0	0	100	100	100	95-100	40-55	15-30
	10-29	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	40-65	20-40
	29-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	100	95-100	35-55	20-35
894D2:												
Bucknell--------	0-7	Silty clay loam	CL	A-6, A-7	0	0	95-100	95-100	80-95	70-95	35-45	15-25
	7-49	Clay, clay loam	CH	A-7	0	0	95-100	95-100	90-100	85-100	50-60	25-35
	49-60	Clay loam------	CL	A-6, A-7	0	0	95-100	95-100	70-90	55-85	35-50	15-30
Gara------------	0-7	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	70-85	55-75	35-45	15-25
	7-47	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	47-60	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
993D2:												
Gara------------	0-7	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	70-85	55-75	35-45	15-25
	7-47	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	47-60	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
Armstrong-------	0-6	Clay loam------	CL	A-6, A-7	0	0-5	90-100	80-95	75-90	55-80	35-45	15-25
	6-35	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	35-60	Clay loam------	CL	A-6	0	0-5	90-100	80-95	70-90	55-80	30-40	15-20
1711:												
Nodaway---------	0-8	Silt loam------	CL, CL-ML	A-4, A-6	0	0	100	95-100	95-100	90-100	25-35	5-15
	8-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	0	100	95-100	95-100	90-100	25-40	5-15

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1711:												
Lawson----------	0-9	Silt loam------	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	85-100	20-40	5-20
	9-34	Silt loam, silty clay loam.	CL, CL-ML	A-4	0	0	100	100	90-100	85-100	20-30	5-10
	34-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	90-100	60-100	20-45	10-25
5021:												
Orthents.												
5025:												
Strip mines-----	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
5040:												
Orthents.												

Physical Properties of the Soils

(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer)

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodibility group	Wind erodibility index
	In	Pct	g/cc	In/hr	In/in		Pct					
13B:												
Zook------------	0-7	35-40	1.30-1.35	0.20-0.60	0.21-0.23	High-----	2.4-7.0	0.37	0.37	5	6	38
	7-60	36-45	1.30-1.45	0.06-0.20	0.11-0.13	High-----	2.0-4.0	0.28	0.28			
Olmitz----------	0-8	24-27	1.40-1.45	0.60-2.00	0.19-0.21	Moderate	2.4-7.0	0.24	0.24	5	6	48
	8-38	24-30	1.40-1.45	0.60-2.00	0.19-0.21	Moderate	2.0-3.0	0.28	0.28			
	38-60	27-34	1.45-1.55	0.60-2.00	0.15-0.17	Moderate	1.0-2.0	0.28	0.28			
Vesser----------	0-14	20-26	1.30-1.35	0.60-2.00	0.20-0.24	Moderate	2.4-7.0	0.28	0.28	5	6	48
	14-33	18-22	1.35-1.40	0.60-2.00	0.18-0.22	Moderate	1.0-2.0	0.43	0.43			
	33-60	30-35	1.40-1.45	0.60-2.00	0.17-0.21	Moderate	0.0-1.0	0.43	0.43			
23C:												
Arispe----------	0-10	28-38	1.35-1.40	0.60-2.00	0.21-0.23	High-----	3.0-4.0	0.37	0.37	3	7	38
	10-22	38-42	1.35-1.45	0.06-0.20	0.18-0.20	High-----	0.5-1.0	0.43	0.43			
	22-43	30-38	1.35-1.45	0.20-0.60	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
	43-60	24-35	1.40-1.50	0.60-2.00	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
23C2:												
Arispe----------	0-6	28-38	1.35-1.40	0.60-2.00	0.21-0.23	High-----	2.2-3.2	0.37	0.37	3	7	38
	6-22	38-42	1.35-1.45	0.06-0.20	0.18-0.20	High-----	0.5-1.0	0.43	0.43			
	22-43	30-38	1.35-1.45	0.20-0.60	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
	43-60	24-35	1.40-1.50	0.60-2.00	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
24D:												
Shelby----------	0-11	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	3.0-4.0	0.28	0.28	5	6	48
	11-56	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.37	0.37			
	56-60	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.37	0.37			
24D2:												
Shelby----------	0-6	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	2.2-3.2	0.32	0.32	5	6	48
	6-15	30-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	1.0-2.0	0.28	0.28			
	15-50	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.28	0.28			
	50-60	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	0.37			
24E2:												
Shelby----------	0-6	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	2.2-3.2	0.32	0.32	5	6	48
	6-15	30-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	1.0-2.0	0.28	0.28			
	15-50	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.28	0.28			
	50-60	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	0.37			
24E3:												
Shelby----------	0-6	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	1.2-2.2	0.37	0.37	4	6	48
	6-50	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.37	0.37			
	50-60	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.37	0.37			
24F2:												
Shelby----------	0-6	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	2.2-3.2	0.32	0.32	5	6	48
	6-15	30-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	1.0-2.0	0.28	0.28			
	15-50	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.28	0.28			
	50-60	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	0.37			
51:												
Vesser----------	0-14	20-26	1.30-1.35	0.60-2.00	0.20-0.24	Moderate	3.0-4.0	0.28	0.28	5	6	48
	14-33	18-22	1.35-1.40	0.60-2.00	0.18-0.22	Moderate	1.0-2.0	0.43	0.43			
	33-60	30-35	1.40-1.45	0.60-2.00	0.17-0.21	Moderate	0.0-1.0	0.43	0.43			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors K	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
51+:												
Vesser----------	0-14	20-26	1.30-1.35	0.60-2.00	0.20-0.24	Moderate	1.5-2.5	0.28	0.28	5	6	48
	14-33	18-22	1.35-1.40	0.60-2.00	0.18-0.22	Moderate	1.0-2.0	0.43	0.43			
	33-60	30-35	1.40-1.45	0.60-2.00	0.17-0.21	Moderate	0.0-1.0	0.43	0.43			
51B:												
Vesser----------	0-14	20-26	1.30-1.35	0.60-2.00	0.20-0.24	Moderate	2.5-3.5	0.28	0.28	5	6	48
	14-33	18-22	1.35-1.40	0.60-2.00	0.18-0.22	Moderate	1.0-2.0	0.43	0.43			
	33-60	30-35	1.40-1.45	0.60-2.00	0.17-0.21	Moderate	0.0-1.0	0.43	0.43			
51B+:												
Vesser----------	0-14	20-26	1.30-1.35	0.60-2.00	0.20-0.24	Moderate	1.5-2.5	0.28	0.28	5	6	48
	14-33	18-22	1.35-1.40	0.60-2.00	0.18-0.22	Moderate	1.0-2.0	0.43	0.43			
	33-60	30-35	1.40-1.45	0.60-2.00	0.17-0.21	Moderate	0.0-1.0	0.43	0.43			
54:												
Zook------------	0-7	35-40	1.30-1.35	0.20-0.60	0.21-0.23	High-----	5.0-7.0	0.37	0.37	5	7	38
	7-37	36-45	1.30-1.45	0.06-0.20	0.11-0.13	High-----	2.0-4.0	0.28	0.28			
	37-60	20-45	1.30-1.45	0.06-0.60	0.11-0.22	High-----	0.0-1.0	0.28	0.28			
54+:												
Zook------------	0-12	20-26	1.30-1.35	0.60-2.00	0.22-0.24	Moderate	2.0-4.0	0.37	0.37	4	6	48
	12-42	36-45	1.30-1.45	0.06-0.20	0.11-0.13	High-----	2.0-4.0	0.28	0.28			
	42-60	20-45	1.30-1.45	0.06-0.60	0.11-0.22	High-----	0.0-1.0	0.28	0.28			
54B:												
Zook------------	0-7	35-40	1.30-1.35	0.20-0.60	0.21-0.23	High-----	5.0-7.0	0.37	0.37	5	7	38
	7-60	36-45	1.30-1.45	0.06-0.20	0.11-0.13	High-----	3.0-4.0	0.28	0.28			
65E:												
Lindley---------	0-7	18-27	1.20-1.40	0.60-2.00	0.16-0.18	Low------	2.0-3.0	0.32	0.32	5	6	48
	7-41	25-35	1.40-1.60	0.20-0.60	0.14-0.18	Moderate	0.1-1.0	0.32	0.32			
	41-60	18-32	1.45-1.65	0.20-0.60	0.12-0.16	Moderate	0.1-0.5	0.32	0.32			
65E2:												
Lindley---------	0-5	18-27	1.20-1.40	0.60-2.00	0.16-0.18	Low------	1.5-2.5	0.32	0.32	5	6	48
	5-39	25-35	1.40-1.60	0.20-0.60	0.14-0.18	Moderate	0.1-1.0	0.32	0.32			
	39-60	18-32	1.45-1.65	0.20-0.60	0.12-0.16	Moderate	0.1-0.5	0.32	0.32			
65F:												
Lindley---------	0-7	18-27	1.20-1.40	0.60-2.00	0.16-0.18	Low------	2.0-3.0	0.32	0.32	5	6	48
	7-41	25-35	1.40-1.60	0.20-0.60	0.14-0.18	Moderate	0.1-1.0	0.32	0.32			
	41-60	18-32	1.45-1.65	0.20-0.60	0.12-0.16	Moderate	0.1-0.5	0.32	0.32			
65F2:												
Lindley---------	0-5	18-27	1.20-1.40	0.60-2.00	0.16-0.18	Low------	1.5-2.5	0.32	0.32	5	6	48
	5-39	25-35	1.40-1.60	0.20-0.60	0.14-0.18	Moderate	0.1-1.0	0.32	0.32			
	39-60	18-32	1.45-1.65	0.20-0.60	0.12-0.16	Moderate	0.1-0.5	0.32	0.32			
65G:												
Lindley---------	0-7	18-27	1.20-1.40	0.60-2.00	0.16-0.18	Low------	2.0-3.0	0.32	0.32	5	6	48
	7-41	25-35	1.40-1.60	0.20-0.60	0.14-0.18	Moderate	0.1-1.0	0.32	0.32			
	41-60	18-32	1.45-1.65	0.20-0.60	0.12-0.16	Moderate	0.1-0.5	0.32	0.32			
65G2:												
Lindley---------	0-5	18-27	1.20-1.40	0.60-2.00	0.16-0.18	Low------	1.5-2.5	0.32	0.32	5	6	48
	5-39	25-35	1.40-1.60	0.20-0.60	0.14-0.18	Moderate	0.1-1.0	0.32	0.32			
	39-60	18-32	1.45-1.65	0.20-0.60	0.12-0.16	Moderate	0.1-0.5	0.32	0.32			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Kf	T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
93D2:												
Shelby----------	0-6	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	2.2-3.2	0.32	0.32	5	6	48
	6-15	30-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	1.0-2.0	0.28	0.28			
	15-50	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.28	0.28			
	50-60	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	0.37			
Adair-----------	0-6	35-42	1.45-1.50	0.20-0.60	0.17-0.19	Moderate	2.2-3.2	0.32	0.32	3	6	86
	6-29	38-60	1.55-1.60	0.06-0.20	0.13-0.16	High-----	0.5-1.0	0.32	0.32			
	29-60	30-38	1.60-1.70	0.20-0.60	0.14-0.16	Moderate	0.0-0.5	0.32	0.32			
94D2:												
Mystic----------	0-9	27-35	1.40-1.45	0.60-2.00	0.22-0.24	Moderate	2.0-3.0	0.32	0.32	3	6	48
	9-51	30-48	1.55-1.65	0.06-0.20	0.15-0.19	High-----	0.0-0.5	0.37	0.37			
	51-60	20-35	1.65-1.75	0.60-2.00	0.16-0.18	Moderate	0.0-0.5	0.37	0.37			
Caleb-----------	0-7	22-27	1.45-1.50	0.60-2.00	0.14-0.18	Low------	2.0-3.0	0.28	0.28	5	6	48
	7-43	20-35	1.45-1.65	0.60-2.00	0.14-0.18	Moderate	0.0-0.5	0.32	0.32			
	43-60	5-30	1.55-1.75	0.60-2.00	0.12-0.16	Low------	0.0-0.5	0.32	0.32			
94E2:												
Mystic----------	0-9	27-35	1.40-1.45	0.60-2.00	0.22-0.24	Moderate	2.0-3.0	0.32	0.32	3	6	48
	9-51	30-48	1.55-1.65	0.06-0.20	0.15-0.19	High-----	0.0-0.5	0.37	0.37			
	51-60	20-35	1.65-1.75	0.60-2.00	0.16-0.18	Moderate	0.0-0.5	0.37	0.37			
Caleb-----------	0-7	22-27	1.45-1.50	0.60-2.00	0.14-0.18	Low------	2.0-3.0	0.28	0.28	5	6	48
	7-43	20-35	1.45-1.65	0.60-2.00	0.14-0.18	Moderate	0.0-0.5	0.32	0.32			
	43-60	5-30	1.55-1.75	0.60-2.00	0.12-0.16	Low------	0.0-0.5	0.32	0.32			
131B:												
Pershing--------	0-11	20-27	1.30-1.40	0.60-2.00	0.22-0.24	Low------	2.5-3.5	0.37	0.37	3	6	48
	11-15	27-35	1.30-1.40	0.20-0.60	0.20-0.22	Moderate	0.0-1.0	0.43	0.43			
	15-34	35-48	1.35-1.45	0.06-0.20	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
	34-60	24-40	1.35-1.50	0.20-0.60	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
131C:												
Pershing--------	0-11	20-27	1.30-1.40	0.60-2.00	0.22-0.24	Low------	2.5-3.5	0.37	0.37	3	6	48
	11-15	27-35	1.30-1.40	0.20-0.60	0.20-0.22	Moderate	0.0-1.0	0.43	0.43			
	15-34	35-48	1.35-1.45	0.06-0.20	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
	34-60	24-40	1.35-1.50	0.20-0.60	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
131C2:												
Pershing--------	0-6	27-38	1.30-1.40	0.20-0.60	0.22-0.24	Moderate	2.0-3.0	0.37	0.37	3	6	38
	6-9	27-35	1.30-1.40	0.20-0.60	0.20-0.22	Moderate	0.0-1.0	0.43	0.43			
	9-34	35-48	1.35-1.45	0.06-0.20	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
	34-60	24-40	1.35-1.50	0.20-0.60	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
131D2:												
Pershing--------	0-6	27-38	1.30-1.40	0.20-0.60	0.22-0.24	Moderate	2.0-3.0	0.37	0.37	3	6	38
	6-9	27-35	1.30-1.40	0.20-0.60	0.20-0.22	Moderate	0.0-1.0	0.43	0.43			
	9-34	35-48	1.35-1.45	0.06-0.20	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
	34-60	24-40	1.35-1.50	0.20-0.60	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
132B:												
Weller----------	0-12	16-27	1.35-1.45	0.60-2.00	0.22-0.24	Low------	2.0-3.0	0.37	0.37	3	6	48
	12-43	28-48	1.35-1.50	0.06-0.20	0.12-0.18	High-----	0.0-0.5	0.43	0.43			
	43-60	25-40	1.40-1.55	0.20-0.60	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
132C:												
Weller----------	0-12	16-27	1.35-1.45	0.60-2.00	0.22-0.24	Low------	2.0-3.0	0.37	0.37	3	6	48
	12-43	28-48	1.35-1.50	0.06-0.20	0.12-0.18	High-----	0.0-0.5	0.43	0.43			
	43-60	25-40	1.40-1.55	0.20-0.60	0.18-0.20	High-----	0.0-0.5	0.43	0.43			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
132C2:												
Weller----------	0-6	27-36	1.35-1.45	0.20-0.60	0.22-0.24	High-----	1.5-2.5	0.37	0.37	3	6	38
	6-37	28-48	1.35-1.50	0.06-0.20	0.12-0.18	High-----	0.0-0.5	0.43	0.43			
	37-60	25-40	1.40-1.55	0.20-0.60	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
132D2:												
Weller----------	0-6	27-36	1.35-1.45	0.20-0.60	0.22-0.24	High-----	1.5-2.5	0.37	0.37	3	6	38
	6-37	28-48	1.35-1.50	0.06-0.20	0.12-0.18	High-----	0.0-0.5	0.43	0.43			
	37-60	25-40	1.40-1.55	0.20-0.60	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
172:												
Wabash----------	0-8	27-35	1.35-1.50	0.06-0.20	0.21-0.24	High-----	4.0-5.0	0.28	0.28	5	4	38
	8-60	40-60	1.20-1.45	0.00-0.06	0.08-0.12	Very high	1.0-2.0	0.28	0.28			
179D2:												
Gara------------	0-7	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	2.0-3.0	0.32	0.32	5	6	48
	7-47	25-38	1.55-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.32	0.32			
	47-60	24-38	1.65-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	---			
179E:												
Gara------------	0-9	18-27	1.50-1.55	0.60-2.00	0.20-0.22	Moderate	2.5-3.5	0.28	0.28	5	6	48
	9-47	25-38	1.55-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.32	0.32			
	47-60	24-38	1.65-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	0.37			
179E2:												
Gara------------	0-7	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	2.0-3.0	0.32	0.32	5	6	48
	7-47	25-38	1.55-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.32	0.32			
	47-60	24-38	1.65-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	---			
179E3:												
Gara------------	0-7	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	1.0-2.0	0.37	0.37	4	6	48
	7-47	25-38	1.55-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.32	0.32			
	47-60	24-38	1.65-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	0.37			
179F:												
Gara------------	0-9	18-27	1.50-1.55	0.60-2.00	0.20-0.22	Moderate	2.5-3.5	0.28	0.28	5	6	48
	9-47	25-38	1.55-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.32	0.32			
	47-60	24-38	1.65-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	0.37			
179F2:												
Gara------------	0-7	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	2.0-3.0	0.32	0.32	5	6	48
	7-47	25-38	1.55-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.32	0.32			
	47-60	24-38	1.65-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	---			
179G2:												
Gara------------	0-7	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	2.0-3.0	0.32	0.32	5	6	48
	7-47	25-38	1.55-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.32	0.32			
	47-60	24-38	1.65-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	---			
192C2:												
Adair-----------	0-6	35-42	1.45-1.50	0.20-0.60	0.17-0.19	Moderate	2.2-3.2	0.32	0.32	3	6	86
	6-29	38-60	1.55-1.60	0.06-0.20	0.13-0.16	High-----	0.5-1.0	0.32	0.32			
	29-60	30-38	1.60-1.70	0.20-0.60	0.14-0.16	Moderate	0.0-0.5	0.32	0.32			
192D2:												
Adair-----------	0-6	35-42	1.45-1.50	0.20-0.60	0.17-0.19	Moderate	2.2-3.2	0.32	0.32	3	6	86
	6-29	38-60	1.55-1.60	0.06-0.20	0.13-0.16	High-----	0.5-1.0	0.32	0.32			
	29-60	30-38	1.60-1.70	0.20-0.60	0.14-0.16	Moderate	0.0-0.5	0.32	0.32			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors K	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
211:												
Edina-----------	0-9	15-27	1.35-1.45	0.60-2.00	0.22-0.24	Moderate	3.5-4.5	0.37	0.37	3	6	48
	9-16	15-27	1.35-1.45	0.60-2.00	0.20-0.22	Moderate	0.5-1.0	0.37	0.37			
	16-43	45-60	1.30-1.45	0.00-0.06	0.11-0.13	Very high	0.0-0.5	0.37	0.37			
	43-60	27-40	1.35-1.50	0.06-0.20	0.18-0.20	High-----	0.0-0.5	0.37	0.37			
220:												
Nodaway---------	0-8	18-27	1.25-1.35	0.60-2.00	0.20-0.23	Low------	1.5-2.5	0.32	0.32	5	6	48
	8-60	18-28	1.25-1.35	0.60-2.00	0.20-0.23	Moderate	0.0-0.5	0.43	0.43			
222C:												
Clarinda--------	0-14	27-38	1.45-1.50	0.20-0.60	0.17-0.19	Moderate	3.0-4.0	0.37	0.37	3	7	38
	14-45	40-60	1.50-1.65	0.00-0.06	0.14-0.16	High-----	0.5-1.0	0.37	0.37			
	45-60	40-60	1.50-1.65	0.00-0.06	0.14-0.16	High-----	0.0-0.5	0.37	0.37			
222C2:												
Clarinda--------	0-6	27-38	1.45-1.50	0.20-0.60	0.17-0.19	Moderate	2.2-3.2	0.37	0.37	3	7	38
	6-39	40-60	1.50-1.65	0.00-0.60	0.14-0.16	High-----	0.5-1.0	0.37	0.37			
	39-60	40-60	1.50-1.65	0.00-0.06	0.14-0.16	High-----	0.0-0.5	0.37	0.37			
222C3:												
Clarinda--------	0-6	27-38	1.45-1.50	0.20-0.60	0.17-0.19	Moderate	1.7-2.7	0.37	0.37	2	4	38
	6-39	40-60	1.50-1.65	0.00-0.06	0.14-0.16	High-----	0.0-0.5	0.37	0.37			
	39-60	40-60	1.50-1.65	0.00-0.06	0.14-0.16	High-----	0.0-0.5	0.37	0.37			
222D2:												
Clarinda--------	0-6	27-38	1.45-1.50	0.20-0.60	0.17-0.19	Moderate	2.2-3.2	0.37	0.37	3	7	38
	6-39	40-60	1.50-1.65	0.00-0.60	0.14-0.16	High-----	0.5-1.0	0.37	0.37			
	39-60	40-60	1.50-1.65	0.00-0.06	0.14-0.16	High-----	0.0-0.5	0.37	0.37			
223C2:												
Rinda-----------	0-7	27-35	1.45-1.50	0.20-0.60	0.20-0.22	Moderate	2.0-3.0	0.43	0.43	3	7	38
	7-11	30-40	1.45-1.50	0.20-0.60	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
	11-60	40-60	1.50-1.65	0.00-0.06	0.14-0.16	High-----	0.0-0.5	0.32	0.32			
223D2:												
Rinda-----------	0-7	27-35	1.45-1.50	0.20-0.60	0.20-0.22	Moderate	2.0-3.0	0.43	0.43	3	7	38
	7-11	30-40	1.45-1.50	0.20-0.60	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
	11-60	40-60	1.50-1.65	0.00-0.06	0.14-0.16	High-----	0.0-0.5	0.32	0.32			
269:												
Humeston--------	0-14	27-30	1.35-1.40	0.20-0.60	0.21-0.23	Moderate	3.0-4.0	0.37	0.37	5	7	38
	14-24	20-26	1.30-1.35	0.20-2.00	0.20-0.22	Moderate	1.0-2.0	0.43	0.43			
	24-60	30-48	1.35-1.50	0.00-0.06	0.13-0.15	High-----	0.5-1.0	0.32	0.32			
269+:												
Humeston--------	0-14	24-27	1.35-1.40	0.60-2.00	0.21-0.23	Low------	1.0-2.0	0.43	0.43	5	6	48
	14-24	20-26	1.30-1.35	0.20-2.00	0.20-0.22	Moderate	1.0-2.0	0.43	0.43			
	24-60	30-48	1.35-1.50	0.00-0.06	0.13-0.15	High-----	0.5-1.0	0.32	0.32			
273B:												
Olmitz----------	0-9	24-27	1.40-1.45	0.60-2.00	0.19-0.21	Moderate	3.0-4.0	0.24	0.24	5	6	48
	9-28	24-30	1.40-1.45	0.60-2.00	0.19-0.21	Moderate	2.0-3.0	0.28	0.28			
	28-60	27-34	1.45-1.55	0.60-2.00	0.15-0.17	Moderate	1.0-2.0	0.28	0.28			
273C:												
Olmitz----------	0-9	24-27	1.40-1.45	0.60-2.00	0.19-0.21	Moderate	3.0-4.0	0.24	0.24	5	6	48
	9-28	24-30	1.40-1.45	0.60-2.00	0.19-0.21	Moderate	2.0-3.0	0.28	0.28			
	28-60	27-34	1.45-1.55	0.60-2.00	0.15-0.17	Moderate	1.0-2.0	0.28	0.28			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
313D2:												
Gosport----------	0-6	27-34	1.30-1.40	0.20-0.60	0.14-0.16	Moderate	1.5-2.5	0.43	0.43	3	6	38
	6-36	36-60	1.50-1.60	0.00-0.06	0.12-0.14	High-----	0.0-0.5	0.32	0.32			
	36-60	---	---	0.00-0.06	---	---	---	---	---			
313E2:												
Gosport----------	0-6	27-34	1.30-1.40	0.20-0.60	0.14-0.16	Moderate	1.5-2.5	0.43	0.43	3	6	38
	6-36	36-60	1.50-1.60	0.00-0.06	0.12-0.14	High-----	0.0-0.5	0.32	0.32			
	36-60	---	---	0.00-0.06	---	---	---	---	---			
313F:												
Gosport----------	0-9	27-34	1.30-1.40	0.20-0.60	0.14-0.16	Moderate	2.0-3.0	0.43	0.43	3	6	38
	9-39	36-60	1.50-1.60	0.00-0.06	0.12-0.14	High-----	0.0-0.5	0.32	0.32			
	39-60	---	---	0.00-0.06	---	---	---	---	---			
313F2:												
Gosport----------	0-6	27-34	1.30-1.40	0.20-0.60	0.14-0.16	Moderate	1.5-2.5	0.43	0.43	3	6	38
	6-36	36-60	1.50-1.60	0.00-0.06	0.12-0.14	High-----	0.0-0.5	0.32	0.32			
	36-60	---	---	0.00-0.06	---	---	---	---	---			
362:												
Haig-------------	0-7	22-27	1.35-1.40	0.60-2.00	0.22-0.24	Moderate	3.5-4.5	0.37	0.37	3	6	48
	7-21	28-48	1.30-1.35	0.60-2.00	0.21-0.23	High-----	1.0-2.0	0.37	0.37			
	21-51	40-50	1.30-1.45	0.00-0.20	0.12-0.14	High-----	0.0-1.0	0.32	0.32			
	51-60	28-40	1.40-1.50	0.20-0.60	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
364B:												
Grundy-----------	0-12	28-35	1.35-1.45	0.20-0.60	0.18-0.20	High-----	3.0-4.0	0.37	0.37	3	7	38
	12-15	32-45	1.35-1.45	0.20-0.60	0.18-0.20	High-----	0.5-1.0	0.37	0.37			
	15-35	40-50	1.30-1.40	0.06-0.20	0.11-0.13	High-----	0.0-0.5	0.37	0.37			
	35-60	28-35	1.35-1.40	0.06-0.20	0.18-0.20	High-----	0.0-0.5	0.37	0.37			
423C2:												
Bucknell---------	0-7	27-38	1.45-1.50	0.20-0.60	0.17-0.21	Moderate	2.0-3.0	0.37	0.37	3	7	38
	7-49	38-50	1.55-1.65	0.00-0.20	0.13-0.17	High-----	0.0-0.5	0.32	0.32			
	49-60	30-40	1.60-1.70	0.06-0.20	0.14-0.18	High-----	0.0-0.5	0.32	0.32			
423D:												
Bucknell---------	0-14	27-38	1.45-1.50	0.20-0.60	0.17-0.21	Moderate	2.5-3.5	0.37	0.37	3	7	38
	14-54	38-50	1.55-1.65	0.00-0.20	0.13-0.17	High-----	0.0-1.0	0.32	0.32			
	54-60	30-40	1.60-1.70	0.06-0.20	0.14-0.18	High-----	0.0-0.5	0.32	0.32			
423D2:												
Bucknell---------	0-7	27-38	1.45-1.50	0.20-0.60	0.17-0.21	Moderate	2.0-3.0	0.37	0.37	3	7	38
	7-49	38-50	1.55-1.65	0.00-0.20	0.13-0.17	High-----	0.0-0.5	0.32	0.32			
	49-60	30-40	1.60-1.70	0.06-0.20	0.14-0.18	High-----	0.0-0.5	0.32	0.32			
425D:												
Keswick----------	0-6	22-27	1.45-1.50	0.60-2.00	0.17-0.22	Moderate	2.0-3.0	0.32	0.32	3	6	48
	6-29	35-60	1.55-1.60	0.06-0.20	0.11-0.15	High-----	0.0-0.5	0.37	0.37			
	29-60	30-40	1.60-1.75	0.20-0.60	0.12-0.16	Moderate	0.0-0.5	0.37	0.37			
425D2:												
Keswick----------	0-5	27-40	1.45-1.50	0.20-0.60	0.17-0.19	Moderate	1.5-2.5	0.37	0.37	3	6	86
	5-24	35-60	1.55-1.60	0.06-0.20	0.11-0.15	High-----	0.0-0.5	0.37	0.37			
	24-60	30-40	1.60-1.75	0.20-0.60	0.12-0.16	Moderate	0.0-0.5	0.37	0.37			
430:												
Ackmore----------	0-8	18-27	1.25-1.30	0.60-2.00	0.21-0.23	Moderate	1.0-3.0	0.32	0.32	5	6	48
	8-28	18-30	1.25-1.30	0.60-2.00	0.21-0.23	Moderate	1.0-3.0	0.32	0.32			
	28-60	26-38	1.30-1.40	0.60-2.00	0.18-0.20	High-----	3.0-5.0	0.32	0.32			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors K	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
451D2:												
Caleb-----------	0-7	22-27	1.45-1.50	0.60-2.00	0.14-0.18	Low------	2.0-3.0	0.28	0.28	5	6	48
	7-43	20-35	1.45-1.65	0.60-2.00	0.14-0.18	Moderate	0.0-0.5	0.32	0.32			
	43-60	5-30	1.55-1.75	0.60-2.00	0.12-0.16	Low------	0.0-0.5	0.32	0.32			
451E2:												
Caleb-----------	0-7	22-27	1.45-1.50	0.60-2.00	0.14-0.18	Low------	2.0-3.0	0.28	0.28	5	6	48
	7-43	20-35	1.45-1.65	0.60-2.00	0.14-0.18	Moderate	0.0-0.5	0.32	0.32			
	43-60	5-30	1.55-1.75	0.60-2.00	0.12-0.16	Low------	0.0-0.5	0.32	0.32			
452C:												
Lineville-------	0-11	22-27	1.45-1.50	0.60-2.00	0.16-0.20	Moderate	2.5-3.5	0.37	0.37	3	6	48
	11-19	28-35	1.50-1.55	0.20-0.60	0.17-0.21	Moderate	0.0-0.5	0.37	0.37			
	19-29	20-35	1.65-1.75	0.06-0.20	0.17-0.21	Moderate	0.0-0.5	0.37	0.37			
	29-60	28-45	1.65-1.75	0.06-0.20	0.13-0.21	High-----	0.0-0.5	0.37	0.37			
452C2:												
Lineville-------	0-6	22-27	1.45-1.50	0.60-2.00	0.16-0.20	Moderate	2.0-3.0	0.37	0.37	3	6	48
	6-19	28-35	1.50-1.55	0.20-0.60	0.17-0.21	Moderate	0.0-0.5	0.37	0.37			
	19-33	20-35	1.65-1.75	0.06-0.20	0.17-0.21	Moderate	0.0-0.5	0.37	0.37			
	33-60	28-45	1.65-1.75	0.06-0.20	0.13-0.21	High-----	0.0-0.5	0.37	0.37			
453:												
Tuskeego--------	0-20	16-22	1.35-1.40	0.60-2.00	0.19-0.23	Moderate	3.0-4.0	0.37	0.37	5	6	56
	20-32	18-30	1.40-1.50	0.06-0.20	0.18-0.22	Moderate	1.0-2.0	0.43	---			
	32-60	32-48	1.30-1.45	0.00-0.06	0.13-0.17	High-----	0.0-2.0	0.43	0.43			
470D2:												
Lamoni----------	0-6	27-40	1.45-1.50	0.20-0.60	0.17-0.21	Moderate	2.2-3.2	0.37	0.37	3	6	38
	6-34	38-50	1.55-1.65	0.00-0.20	0.13-0.17	High-----	0.5-2.0	0.37	0.37			
	34-60	32-40	1.60-1.70	0.06-0.20	0.14-0.18	High-----	0.0-0.5	0.37	0.37			
Shelby----------	0-6	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	2.2-3.2	0.32	0.32	5	6	48
	6-15	30-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	1.0-2.0	0.28	0.28			
	15-50	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.28	0.28			
	50-60	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	0.37			
484:												
Lawson----------	0-9	10-27	1.20-1.55	0.60-2.00	0.22-0.24	Low------	4.4-6.0	0.28	0.28	5	6	56
	9-34	10-30	1.20-1.55	0.60-2.00	0.18-0.22	Low------	3.0-7.0	0.28	0.28			
	34-60	18-30	1.55-1.65	0.60-2.00	0.18-0.20	Moderate	1.0-4.0	0.43	0.43			
587:												
Chequest--------	0-12	30-35	1.30-1.35	0.20-0.60	0.18-0.20	High-----	3.0-4.0	0.32	0.32	5	7	38
	12-60	35-42	1.35-1.45	0.20-0.60	0.14-0.18	High-----	0.0-1.0	0.43	0.43			
587+:												
Chequest--------	0-15	20-26	1.20-1.25	0.60-2.00	0.20-0.22	Low------	1.0-3.0	0.37	0.37	5	6	48
	15-60	35-42	1.35-1.45	0.20-0.60	0.14-0.18	High-----	0.0-1.0	0.43	0.43			
592C2:												
Mystic----------	0-9	27-35	1.40-1.45	0.60-2.00	0.22-0.24	Moderate	2.0-3.0	0.32	0.32	3	6	48
	9-51	30-48	1.55-1.65	0.06-0.20	0.15-0.19	High-----	0.0-0.5	0.37	0.37			
	51-60	20-35	1.65-1.75	0.60-2.00	0.16-0.18	Moderate	0.0-0.5	0.37	0.37			
592D2:												
Mystic----------	0-9	27-35	1.40-1.45	0.60-2.00	0.22-0.24	Moderate	2.0-3.0	0.32	0.32	3	6	48
	9-51	30-48	1.55-1.65	0.06-0.20	0.15-0.19	High-----	0.0-0.5	0.37	0.37			
	51-60	20-35	1.65-1.75	0.60-2.00	0.16-0.18	Moderate	0.0-0.5	0.37	0.37			
711:												
Nodaway---------	0-8	18-27	1.25-1.35	0.60-2.00	0.20-0.23	Low------	1.4-6.0	0.32	0.32	5	6	48
	8-60	18-28	1.25-1.35	0.60-2.00	0.20-0.23	Moderate	0.0-0.5	0.43	0.43			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
711:												
Lawson----------	0-9	10-27	1.20-1.55	0.60-2.00	0.22-0.24	Low------	1.4-6.0	0.28	0.28	5	6	56
	9-34	10-30	1.20-1.55	0.60-2.00	0.18-0.22	Low------	3.0-7.0	0.28	0.28			
	34-60	18-30	1.55-1.65	0.60-2.00	0.18-0.20	Moderate	1.0-4.0	0.43	0.43			
792C:												
Armstrong-------	0-11	22-27	1.45-1.50	0.60-2.00	0.20-0.22	Moderate	2.5-3.5	0.32	0.32	3	6	48
	11-40	36-60	1.55-1.60	0.06-0.20	0.11-0.16	High-----	0.0-1.0	0.32	0.32			
	40-60	30-36	1.55-1.70	0.20-0.60	0.14-0.16	Moderate	0.0-0.5	0.32	0.32			
792C2:												
Armstrong-------	0-6	35-42	1.45-1.50	0.20-0.60	0.18-0.20	Moderate	2.0-3.0	0.32	0.32	3	6	86
	6-34	36-60	1.55-1.60	0.06-0.20	0.11-0.16	High-----	0.0-1.0	0.32	0.32			
	34-60	30-36	1.55-1.70	0.20-0.60	0.14-0.16	Moderate	0.0-0.5	0.32	0.32			
792D:												
Armstrong-------	0-11	22-27	1.45-1.50	0.60-2.00	0.20-0.22	Moderate	2.5-3.5	0.32	0.32	3	6	48
	11-40	36-60	1.55-1.60	0.06-0.20	0.11-0.16	High-----	0.0-1.0	0.32	0.32			
	40-60	30-36	1.55-1.70	0.20-0.60	0.14-0.16	Moderate	0.0-0.5	0.32	0.32			
792D2:												
Armstrong-------	0-6	35-42	1.45-1.50	0.20-0.60	0.18-0.20	Moderate	2.0-3.0	0.32	0.32	3	6	86
	6-34	36-60	1.55-1.60	0.06-0.20	0.11-0.16	High-----	0.0-1.0	0.32	0.32			
	34-60	30-36	1.55-1.70	0.20-0.60	0.14-0.16	Moderate	0.0-0.5	0.32	0.32			
792D3:												
Armstrong-------	0-6	35-42	1.45-1.50	0.20-0.60	0.18-0.20	Moderate	1.5-2.5	0.37	0.37	2	6	86
	6-34	36-60	1.55-1.60	0.06-0.20	0.11-0.16	High-----	0.0-0.5	0.32	0.32			
	34-60	30-36	1.55-1.70	0.20-0.60	0.14-0.16	Moderate	0.0-0.5	0.32	0.32			
822C:												
Lamoni----------	0-14	27-40	1.45-1.50	0.20-0.60	0.17-0.21	Moderate	3.0-4.0	0.37	0.37	3	7	38
	14-42	38-50	1.55-1.65	0.00-0.20	0.13-0.17	High-----	0.0-0.5	0.37	0.37			
	42-60	32-40	1.60-1.70	0.06-0.20	0.14-0.18	High-----	0.0-0.5	0.37	0.37			
822C2:												
Lamoni----------	0-6	27-40	1.45-1.50	0.20-0.60	0.17-0.21	Moderate	2.2-3.2	0.37	0.37	3	7	38
	6-34	38-50	1.55-1.65	0.00-0.20	0.13-0.17	High-----	0.5-2.0	0.37	0.37			
	34-60	32-40	1.60-1.70	0.06-0.20	0.14-0.18	High-----	0.0-0.5	0.37	0.37			
822D:												
Lamoni----------	0-14	27-40	1.45-1.50	0.20-0.60	0.17-0.21	Moderate	3.0-4.0	0.37	0.37	3	7	38
	14-42	38-50	1.55-1.65	0.00-0.20	0.13-0.17	High-----	0.0-0.5	0.37	0.37			
	42-60	32-40	1.60-1.70	0.06-0.20	0.14-0.18	High-----	0.0-0.5	0.37	0.37			
822D2:												
Lamoni----------	0-6	27-40	1.45-1.50	0.20-0.60	0.17-0.21	Moderate	2.2-3.2	0.37	0.37	3	7	38
	6-34	38-50	1.55-1.65	0.00-0.20	0.13-0.17	High-----	0.5-2.0	0.37	0.37			
	34-60	32-40	1.60-1.70	0.06-0.20	0.14-0.18	High-----	0.0-0.5	0.37	0.37			
831B:												
Pershing--------	0-11	20-27	1.30-1.40	0.60-2.00	0.22-0.24	Low------	2.5-3.5	0.37	0.37	3	6	48
	11-15	27-35	1.30-1.40	0.20-0.60	0.20-0.22	Moderate	0.0-1.0	0.43	0.43			
	15-34	35-48	1.35-1.45	0.06-0.20	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
	34-60	24-40	1.35-1.50	0.20-0.60	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
831C:												
Pershing--------	0-11	20-27	1.30-1.40	0.60-2.00	0.22-0.24	Low------	2.5-3.5	0.37	0.37	3	6	48
	11-15	27-35	1.30-1.40	0.20-0.60	0.20-0.22	Moderate	0.0-1.0	0.43	0.43			
	15-34	35-48	1.35-1.45	0.06-0.20	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
	34-60	24-40	1.35-1.50	0.20-0.60	0.18-0.20	High-----	0.0-0.5	0.43	0.43			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
831C2:												
Pershing--------	0-6	27-38	1.30-1.40	0.20-0.60	0.22-0.24	Moderate	2.0-3.0	0.37	0.37	3	7	38
	6-10	27-35	1.30-1.40	0.20-0.60	0.20-0.22	Moderate	0.0-1.0	0.43	0.43			
	10-29	35-48	1.35-1.45	0.06-0.20	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
	29-60	24-40	1.35-1.50	0.20-0.60	0.18-0.20	High-----	0.0-0.5	0.43	0.43			
894D2:												
Bucknell--------	0-7	27-38	1.45-1.50	0.20-0.60	0.17-0.21	Moderate	2.0-3.0	0.37	0.37	3	7	38
	7-49	38-50	1.55-1.65	0.00-0.20	0.13-0.17	High-----	0.0-0.5	0.32	0.32			
	49-60	30-40	1.60-1.70	0.06-0.20	0.14-0.18	High-----	0.0-0.5	0.32	0.32			
Gara------------	0-7	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	2.0-3.0	0.32	0.32	5	6	48
	7-47	25-38	1.55-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.32	0.32			
	47-60	24-38	1.65-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	---			
993D2:												
Gara------------	0-7	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	2.0-3.0	0.32	0.32	5	6	48
	7-47	25-38	1.55-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.32	0.32			
	47-60	24-38	1.65-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	---			
Armstrong-------	0-6	35-42	1.45-1.50	0.20-0.60	0.18-0.20	Moderate	2.0-3.0	0.32	0.32	3	6	86
	6-35	36-60	1.55-1.60	0.06-0.20	0.11-0.16	High-----	0.0-1.0	0.32	0.32			
	35-60	30-36	1.55-1.70	0.20-0.60	0.14-0.16	Moderate	0.0-0.5	0.32	0.32			
1711:												
Nodaway---------	0-8	18-27	1.25-1.35	0.60-2.00	0.20-0.23	Low------	1.4-6.0	0.32	0.32	5	5	48
	8-60	18-28	1.25-1.35	0.60-2.00	0.20-0.23	Moderate	0.0-0.5	0.43	0.43			
Lawson----------	0-9	10-27	1.20-1.55	0.60-2.00	0.22-0.24	Low------	1.4-6.0	0.28	0.28	5	5	56
	9-34	10-30	1.20-1.55	0.60-2.00	0.18-0.22	Low------	3.0-7.0	0.28	0.28			
	34-60	18-30	1.55-1.65	0.60-2.00	0.18-0.20	Moderate	1.0-4.0	0.43	0.43			
5021:												
Orthents.												
5025:												
Strip mines-----	0-60	---	---	0.01-20.00	---	---	---	---	---	5	8	---
5040:												
Orthents.												

Chemical Properties of the Soils

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
13B:					
Zook------------	0-7	35-40	36.0-41.0	5.6-7.3	---
	7-60	36-45	36.0-41.0	5.6-7.8	0-15
Olmitz----------	0-8	24-27	20.0-25.0	5.6-7.3	---
	8-38	24-30	20.0-25.0	5.6-7.3	---
	38-60	27-34	20.0-25.0	5.1-6.5	---
Vesser----------	0-14	20-26	25.0-30.0	5.6-7.3	---
	14-33	18-22	20.0-25.0	5.1-6.0	---
	33-60	30-35	25.0-30.0	5.6-6.5	---
23C:					
Arispe----------	0-10	28-38	25.0-30.0	5.6-7.3	---
	10-22	38-42	30.0-36.0	5.6-7.3	---
	22-43	30-38	25.0-30.0	6.6-7.3	---
	43-60	24-35	25.0-30.0	5.6-7.3	---
23C2:					
Arispe----------	0-6	28-38	25.0-30.0	5.6-7.3	---
	6-22	38-42	25.0-30.0	5.6-7.3	---
	22-43	30-38	25.0-30.0	6.6-7.3	---
	43-60	24-35	25.0-30.0	5.6-7.3	---
24D:					
Shelby----------	0-11	27-35	20.0-25.0	5.1-7.3	---
	11-56	30-35	20.0-25.0	5.1-7.3	---
	56-60	30-35	20.0-25.0	6.6-8.4	0-30
24D2:					
Shelby----------	0-6	27-35	20.0-25.0	5.1-7.3	---
	6-15	30-35	20.0-25.0	5.1-7.3	---
	15-50	30-35	20.0-25.0	5.1-7.3	---
	50-60	30-35	20.0-25.0	6.6-8.4	0-30
24E2:					
Shelby----------	0-6	27-35	20.0-25.0	5.1-7.3	---
	6-15	30-35	20.0-25.0	5.1-7.3	---
	15-50	30-35	20.0-25.0	5.1-7.3	---
	50-60	30-35	20.0-25.0	6.6-8.4	0-30
24E3:					
Shelby----------	0-6	27-35	20.0-25.0	5.1-7.3	---
	6-50	30-35	20.0-25.0	5.1-7.3	---
	50-60	30-35	20.0-25.0	6.6-8.4	0-30
24F2:					
Shelby----------	0-6	27-35	20.0-25.0	5.1-7.3	---
	6-15	30-35	20.0-25.0	5.1-7.3	---
	15-50	30-35	20.0-25.0	5.1-7.3	---
	50-60	30-35	20.0-25.0	6.6-8.4	0-30
51:					
Vesser----------	0-14	20-26	25.0-30.0	5.6-7.3	---
	14-33	18-22	20.0-25.0	5.1-6.0	---
	33-60	30-35	25.0-30.0	5.1-6.5	---
51+:					
Vesser----------	0-14	20-26	25.0-30.0	5.6-7.3	---
	14-33	18-22	20.0-25.0	5.1-6.0	---
	33-60	30-35	25.0-30.0	5.1-6.5	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
51B:					
Vesser----------	0-14	20-26	25.0-30.0	5.6-7.3	---
	14-33	18-22	20.0-25.0	5.1-6.0	---
	33-60	30-35	25.0-30.0	5.6-6.5	---
51B+:					
Vesser----------	0-14	20-26	25.0-30.0	5.6-7.3	---
	14-33	18-22	20.0-25.0	5.1-6.0	---
	33-60	30-35	25.0-30.0	5.6-6.5	---
54:					
Zook------------	0-7	35-40	36.0-41.0	5.6-7.3	---
	7-37	36-45	36.0-41.0	5.6-7.8	---
	37-60	20-45	30.0-36.0	5.6-7.8	---
54+:					
Zook------------	0-12	20-26	20.0-25.0	5.6-7.3	---
	12-42	36-45	36.0-41.0	5.6-7.8	---
	42-60	20-45	30.0-36.0	5.6-7.8	---
54B:					
Zook------------	0-7	35-40	36.0-41.0	5.6-7.3	---
	7-60	36-45	36.0-41.0	5.6-7.8	0-15
65E:					
Lindley---------	0-7	18-27	15.0-20.0	4.5-7.3	---
	7-41	25-35	15.0-20.0	4.5-6.5	---
	41-60	18-32	10.0-16.0	6.1-7.8	---
65E2:					
Lindley---------	0-5	18-27	20.0-25.0	4.5-7.3	---
	5-39	25-35	15.0-20.0	4.5-6.5	---
	39-60	18-32	10.0-16.0	6.1-7.8	---
65F:					
Lindley---------	0-7	18-27	15.0-20.0	4.5-7.3	---
	7-41	25-35	15.0-20.0	4.5-6.5	---
	41-60	18-32	10.0-16.0	6.1-7.8	---
65F2:					
Lindley---------	0-5	18-27	20.0-25.0	4.5-7.3	---
	5-39	25-35	15.0-20.0	4.5-6.5	---
	39-60	18-32	10.0-16.0	6.1-7.8	---
65G:					
Lindley---------	0-7	18-27	15.0-20.0	4.5-7.3	---
	7-41	25-35	15.0-20.0	4.5-6.5	---
	41-60	18-32	10.0-16.0	6.1-7.8	---
65G2:					
Lindley---------	0-5	18-27	20.0-25.0	4.5-7.3	---
	5-39	25-35	15.0-20.0	4.5-6.5	---
	39-60	18-32	10.0-16.0	6.1-7.8	---
93D2:					
Shelby----------	0-6	27-35	20.0-30.0	5.1-7.3	---
	6-15	30-35	20.0-25.0	5.1-7.3	---
	15-50	30-35	20.0-25.0	5.1-7.3	---
	50-60	30-35	20.0-25.0	6.6-8.4	0-30
Adair-----------	0-6	35-42	20.0-30.0	5.6-7.3	---
	6-29	38-60	41.0-50.0	5.1-6.5	---
	29-60	30-38	25.0-30.0	5.6-7.8	5-10

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
94D2:					
Mystic----------	0-9	27-35	25.0-30.0	4.5-7.3	---
	9-51	30-48	25.0-30.0	4.5-6.5	---
	51-60	20-35	20.0-25.0	6.1-6.5	---
Caleb-----------	0-7	22-27	20.0-25.0	4.5-7.3	---
	7-43	20-35	20.0-25.0	4.5-6.0	---
	43-60	5-30	5.0-25.0	6.1-6.5	---
94E2:					
Mystic----------	0-9	27-35	25.0-30.0	4.5-7.3	---
	9-51	30-48	25.0-30.0	4.5-6.5	---
	51-60	20-35	20.0-25.0	6.1-6.5	---
Caleb-----------	0-7	22-27	20.0-25.0	4.5-7.3	---
	7-43	20-35	20.0-25.0	4.5-6.0	---
	43-60	5-30	5.0-25.0	6.1-6.5	---
131B:					
Pershing--------	0-11	20-27	20.0-25.0	4.5-7.3	---
	11-15	27-35	25.0-30.0	5.1-6.0	---
	15-34	35-48	30.0-36.0	5.1-6.0	---
	34-60	24-40	25.0-30.0	5.1-6.5	---
131C:					
Pershing--------	0-11	20-27	20.0-25.0	4.5-7.3	---
	11-15	27-35	25.0-30.0	5.1-6.0	---
	15-34	35-48	30.0-36.0	5.1-6.0	---
	34-60	24-40	25.0-30.0	5.1-6.5	---
131C2:					
Pershing--------	0-6	27-38	25.0-30.0	4.5-7.3	---
	6-9	27-35	25.0-30.0	5.1-6.0	---
	9-34	35-48	30.0-36.0	5.1-6.0	---
	34-60	24-40	25.0-30.0	5.1-6.5	---
131D2:					
Pershing--------	0-6	27-38	25.0-30.0	4.5-7.3	---
	6-9	27-35	25.0-30.0	5.1-6.0	---
	9-34	35-48	30.0-36.0	5.1-6.0	---
	34-60	24-40	25.0-30.0	5.1-6.5	---
132B:					
Weller----------	0-12	16-27	15.0-20.0	4.5-7.3	---
	12-43	28-48	30.0-35.0	4.5-6.0	---
	43-60	25-40	25.0-30.0	5.1-6.5	---
132C:					
Weller----------	0-12	16-27	15.0-20.0	4.5-7.3	---
	12-43	28-48	30.0-35.0	4.5-6.0	---
	43-60	25-40	25.0-30.0	5.1-6.5	---
132C2:					
Weller----------	0-6	27-36	25.0-30.0	4.5-7.3	---
	6-37	28-48	30.0-35.0	4.5-6.0	---
	37-60	25-40	25.0-30.0	5.1-6.5	---
132D2:					
Weller----------	0-6	27-36	30.0-35.0	4.5-7.3	---
	6-37	28-48	30.0-35.0	4.5-6.0	---
	37-60	25-40	25.0-30.0	5.1-6.5	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
172:					
Wabash----------	0-8	27-35	0.0-41.0	5.6-7.3	---
	8-60	40-60	28.0-42.0	5.1-7.8	---
179D2:					
Gara------------	0-7	27-35	25.0-30.0	5.6-7.3	---
	7-47	25-38	25.0-30.0	4.5-6.5	---
	47-60	24-38	25.0-30.0	5.6-8.4	0-25
179E:					
Gara------------	0-9	18-27	20.0-25.0	5.6-7.3	---
	9-47	25-38	20.0-25.0	4.5-6.5	---
	47-60	24-38	20.0-25.0	6.6-8.4	0-25
179E2:					
Gara------------	0-7	27-35	25.0-30.0	5.6-7.3	---
	7-47	25-38	25.0-30.0	4.5-6.5	---
	47-60	24-38	25.0-30.0	5.6-8.4	0-25
179E3:					
Gara------------	0-7	27-35	25.0-30.0	5.6-7.3	---
	7-47	25-38	25.0-30.0	4.5-6.5	---
	47-60	24-38	25.0-30.0	5.6-8.4	0-25
179F:					
Gara------------	0-9	18-27	20.0-25.0	5.6-7.3	---
	9-47	25-38	20.0-25.0	4.5-6.5	---
	47-60	24-38	20.0-25.0	6.6-8.4	0-25
179F2:					
Gara------------	0-7	27-35	25.0-30.0	5.6-7.3	---
	7-47	25-38	25.0-30.0	4.5-6.5	---
	47-60	24-38	25.0-30.0	5.6-8.4	0-25
179G2:					
Gara------------	0-7	27-35	25.0-30.0	5.6-7.3	---
	7-47	25-38	25.0-30.0	4.5-6.5	---
	47-60	24-38	25.0-30.0	5.6-8.4	0-25
192C2:					
Adair-----------	0-6	35-42	25.0-30.0	5.6-7.3	---
	6-29	38-60	41.0-50.0	5.1-6.5	---
	29-60	30-38	25.0-30.0	5.6-7.8	5-10
192D2:					
Adair-----------	0-6	35-42	25.0-30.0	5.6-7.3	---
	6-29	38-60	41.0-50.0	5.1-6.5	---
	29-60	30-38	25.0-30.0	5.6-7.8	5-10
211:					
Edina-----------	0-9	15-27	25.0-30.0	5.1-7.3	---
	9-16	15-27	14.0-20.0	5.1-7.3	---
	16-43	45-60	28.0-42.0	5.1-7.3	---
	43-60	27-40	20.0-30.0	6.1-7.3	---
220:					
Nodaway---------	0-8	18-27	20.0-25.0	6.1-7.3	---
	8-60	18-28	20.0-25.0	6.1-7.3	---
222C:					
Clarinda--------	0-14	27-38	36.0-41.0	5.1-7.3	---
	14-45	40-60	41.0-50.0	5.1-6.5	---
	45-60	40-60	41.0-50.0	5.6-8.4	0-30

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
222C2:					
Clarinda--------	0-6	27-38	36.0-41.0	5.1-7.3	---
	6-39	40-60	41.0-50.0	5.1-6.5	---
	39-60	40-60	41.0-50.0	5.6-8.4	0-30
222C3:					
Clarinda--------	0-6	27-38	36.0-41.0	5.1-7.3	---
	6-39	40-60	41.0-50.0	5.1-6.5	---
	39-60	40-60	41.0-50.0	5.6-8.4	0-30
222D2:					
Clarinda--------	0-6	27-38	36.0-41.0	5.1-7.3	---
	6-39	40-60	41.0-50.0	5.1-6.5	---
	39-60	40-60	41.0-50.0	5.6-8.4	0-30
223C2:					
Rinda-----------	0-7	27-35	30.0-36.0	5.1-7.3	---
	7-11	30-40	30.0-36.0	5.1-6.5	---
	11-60	40-60	41.0-50.0	5.1-7.3	---
223D2:					
Rinda-----------	0-7	27-35	30.0-36.0	5.1-7.3	---
	7-11	30-40	30.0-36.0	5.1-6.5	---
	11-60	40-60	41.0-50.0	5.1-7.3	---
269:					
Humeston--------	0-14	27-30	25.0-30.0	5.1-7.3	---
	14-24	20-26	25.0-30.0	4.5-6.0	---
	24-60	30-48	25.0-36.0	4.5-6.5	---
269+:					
Humeston--------	0-14	24-27	25.0-30.0	5.1-7.3	---
	14-24	20-26	25.0-30.0	4.5-6.0	---
	24-60	30-48	25.0-36.0	4.5-6.5	---
273B:					
Olmitz----------	0-9	24-27	20.0-25.0	5.6-7.3	---
	9-28	24-30	20.0-25.0	5.6-7.3	---
	28-60	27-34	20.0-25.0	5.1-6.5	---
273C:					
Olmitz----------	0-9	24-27	20.0-25.0	5.6-7.3	---
	9-28	24-30	20.0-25.0	5.6-7.3	---
	28-60	27-34	20.0-25.0	5.1-6.5	---
313D2:					
Gosport---------	0-6	27-34	15.0-20.0	5.1-7.3	---
	6-36	36-60	30.0-50.0	3.6-5.5	---
	36-60	---	---	---	---
313E2:					
Gosport---------	0-6	27-34	15.0-20.0	5.1-7.3	---
	6-36	36-60	30.0-50.0	3.6-5.5	---
	36-60	---	---	---	---
313F:					
Gosport---------	0-9	27-34	15.0-20.0	5.1-7.3	---
	9-39	36-60	30.0-50.0	3.6-5.5	---
	39-60	---	---	---	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
313F2:					
Gosport----------	0-6	27-34	15.0-20.0	5.1-7.3	---
	6-36	36-60	30.0-50.0	3.6-5.5	---
	36-60	---	---	---	---
362:					
Haig-------------	0-7	22-27	36.0-41.0	5.6-7.3	---
	7-21	28-48	36.0-41.0	5.1-6.0	---
	21-51	40-50	36.0-41.0	5.1-6.0	---
	51-60	28-40	36.0-41.0	6.1-7.3	---
364B:					
Grundy-----------	0-12	28-35	30.0-36.0	5.6-7.3	---
	12-15	32-45	16.0-24.0	5.6-6.5	---
	15-35	40-50	20.0-26.0	5.1-7.3	---
	35-60	28-35	14.0-19.0	5.6-7.3	---
423C2:					
Bucknell---------	0-7	27-38	20.0-25.0	5.6-7.3	---
	7-49	38-50	36.0-41.0	4.5-6.0	---
	49-60	30-40	30.0-36.0	5.6-7.3	---
423D:					
Bucknell---------	0-14	27-38	20.0-25.0	5.6-7.3	---
	14-54	38-50	36.0-41.0	4.5-6.0	---
	54-60	30-40	30.0-36.0	5.6-7.3	---
423D2:					
Bucknell---------	0-7	27-38	20.0-25.0	5.6-7.3	---
	7-49	38-50	36.0-41.0	4.5-6.0	---
	49-60	30-40	30.0-36.0	5.6-7.3	---
425D:					
Keswick----------	0-6	22-27	20.0-25.0	4.5-7.3	---
	6-29	35-60	30.0-50.0	4.5-6.0	---
	29-60	30-40	30.0-36.0	4.5-7.8	0-15
425D2:					
Keswick----------	0-5	27-40	25.0-30.0	4.5-7.3	---
	5-24	35-60	30.0-50.0	4.5-6.0	---
	24-60	30-40	30.0-36.0	4.5-7.8	0-15
430:					
Ackmore----------	0-8	18-27	25.0-30.0	5.6-7.3	---
	8-28	18-30	25.0-30.0	5.6-7.3	---
	28-60	26-38	25.0-30.0	5.6-7.8	5-10
451D2:					
Caleb------------	0-7	22-27	20.0-25.0	4.5-7.3	---
	7-43	20-35	20.0-25.0	4.5-6.0	---
	43-60	5-30	5.0-25.0	6.1-6.5	---
451E2:					
Caleb------------	0-7	22-27	20.0-25.0	4.5-7.3	---
	7-43	20-35	20.0-25.0	4.5-6.0	---
	43-60	5-30	5.0-25.0	6.1-6.5	---
452C:					
Lineville--------	0-11	22-27	20.0-25.0	5.6-7.3	---
	11-19	28-35	20.0-25.0	5.1-6.0	---
	19-29	20-35	20.0-25.0	5.6-6.0	---
	29-60	28-45	30.0-41.0	5.6-7.3	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
452C2:					
Lineville-------	0-6	22-27	25.0-30.0	5.6-7.3	---
	6-19	28-35	20.0-25.0	5.1-6.0	---
	19-33	20-35	20.0-25.0	5.6-6.0	---
	33-60	28-45	30.0-41.0	5.6-7.3	---
453:					
Tuskeego--------	0-20	16-22	20.0-25.0	5.1-7.3	---
	20-32	18-30	20.0-25.0	5.1-6.5	---
	32-60	32-48	30.0-36.0	5.1-6.5	---
470D2:					
Lamoni----------	0-6	27-40	25.0-30.0	5.1-7.3	---
	6-34	38-50	41.0-50.0	5.1-6.5	---
	34-60	32-40	25.0-30.0	5.6-7.3	---
Shelby----------	0-6	27-35	20.0-25.0	5.1-7.3	---
	6-15	30-35	20.0-25.0	5.1-7.3	---
	15-50	30-35	20.0-25.0	5.1-7.3	---
	50-60	30-35	20.0-25.0	6.6-8.4	0-30
484:					
Lawson----------	0-9	10-27	25.0-30.0	6.1-7.3	---
	9-34	10-30	11.0-29.0	6.1-7.8	---
	34-60	18-30	11.0-23.0	6.1-7.8	---
587:					
Chequest--------	0-12	30-35	25.0-30.0	5.6-7.3	---
	12-60	35-42	25.0-30.0	5.1-6.0	---
587+:					
Chequest--------	0-15	20-26	20.0-25.0	5.6-7.3	---
	15-60	35-42	25.0-30.0	5.1-6.0	---
592C2:					
Mystic----------	0-9	27-35	20.0-25.0	4.5-7.3	---
	9-51	30-48	25.0-30.0	4.5-6.5	---
	51-60	20-35	20.0-25.0	6.1-6.5	---
592D2:					
Mystic----------	0-9	27-35	20.0-25.0	4.5-7.3	---
	9-51	30-48	25.0-30.0	4.5-6.5	---
	51-60	20-35	20.0-25.0	6.1-6.5	---
711:					
Nodaway---------	0-8	18-27	10.0-30.0	6.1-7.3	---
	8-60	18-28	20.0-25.0	6.1-7.3	---
Lawson----------	0-9	10-27	10.0-30.0	6.1-7.8	---
	9-34	10-30	11.0-29.0	6.1-7.8	---
	34-60	18-30	11.0-23.0	6.1-7.8	---
792C:					
Armstrong-------	0-11	22-27	20.0-25.0	5.6-7.3	---
	11-40	36-60	41.0-50.0	4.5-6.5	---
	40-60	30-36	30.0-35.0	5.1-7.8	---
792C2:					
Armstrong-------	0-6	35-42	25.0-30.0	5.6-7.3	---
	6-34	36-60	41.0-50.0	4.5-6.5	---
	34-60	30-36	30.0-35.0	5.1-7.8	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
792D:					
Armstrong--------	0-11	22-27	20.0-25.0	5.6-7.3	---
	11-40	36-60	41.0-50.0	4.5-6.5	---
	40-60	30-36	30.0-35.0	5.1-7.8	---
792D2:					
Armstrong--------	0-6	35-42	25.0-30.0	5.6-7.3	---
	6-34	36-60	41.0-50.0	4.5-6.5	---
	34-60	30-36	30.0-35.0	5.1-7.8	---
792D3:					
Armstrong--------	0-6	35-42	30.0-35.0	5.6-7.3	---
	6-34	36-60	41.0-50.0	4.5-6.5	---
	34-60	30-36	30.0-35.0	5.1-7.8	---
822C:					
Lamoni-----------	0-14	27-40	25.0-30.0	5.5-7.3	---
	14-42	38-50	41.0-50.0	5.1-6.5	---
	42-60	32-40	25.0-30.0	5.6-7.3	---
822C2:					
Lamoni-----------	0-6	27-40	25.0-30.0	5.5-7.3	---
	6-34	38-50	41.0-50.0	5.1-6.5	---
	34-60	32-40	25.0-30.0	5.6-7.3	---
822D:					
Lamoni-----------	0-14	27-40	25.0-30.0	5.5-7.3	---
	14-42	38-50	41.0-50.0	5.1-6.5	---
	42-60	32-40	25.0-30.0	5.6-7.3	---
822D2:					
Lamoni-----------	0-6	27-40	25.0-30.0	5.5-7.3	---
	6-34	38-50	41.0-50.0	5.1-6.5	---
	34-60	32-40	25.0-30.0	5.6-7.3	---
831B:					
Pershing---------	0-11	20-27	25.0-30.0	4.5-7.3	---
	11-15	27-35	25.0-30.0	5.1-6.0	---
	15-34	35-48	30.0-36.0	5.1-6.0	---
	34-60	24-40	25.0-30.0	5.1-6.5	---
831C:					
Pershing---------	0-11	20-27	25.0-30.0	4.5-7.3	---
	11-15	27-35	25.0-30.0	5.1-6.0	---
	15-34	35-48	30.0-36.0	5.1-6.0	---
	34-60	24-40	25.0-30.0	5.1-6.5	---
831C2:					
Pershing---------	0-6	27-38	25.0-30.0	4.5-7.3	---
	6-10	27-35	25.0-30.0	5.1-6.0	---
	10-29	35-48	30.0-36.0	5.1-6.0	---
	29-60	24-40	25.0-30.0	5.1-6.5	---
894D2:					
Bucknell---------	0-7	27-38	20.0-25.0	5.1-7.3	---
	7-49	38-50	36.0-41.0	4.5-6.0	---
	49-60	30-40	30.0-36.0	5.6-7.3	---
Gara-------------	0-7	27-35	25.0-30.0	5.6-7.3	---
	7-47	25-38	25.0-30.0	4.5-6.5	---
	47-60	24-38	25.0-30.0	5.6-8.4	0-25

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
993D2:					
Gara------------	0-7	27-35	25.0-30.0	5.6-7.3	---
	7-47	25-38	25.0-30.0	4.5-6.5	---
	47-60	24-38	25.0-30.0	5.6-8.4	0-25
Armstrong-------	0-6	35-42	30.0-35.0	5.6-7.3	---
	6-35	36-60	41.0-50.0	4.5-6.5	---
	35-60	30-36	30.0-35.0	5.1-7.8	---
1711:					
Nodaway---------	0-8	18-27	10.0-30.0	6.1-7.3	---
	8-60	18-28	20.0-25.0	6.1-7.3	---
Lawson----------	0-9	10-27	10.0-30.0	6.1-7.8	---
	9-34	10-30	11.0-29.0	6.1-7.8	---
	34-60	18-30	11.0-23.0	6.1-7.8	---
5021:					
Orthents.					
5025:					
Strip mines.					
5040:					
Orthents.					

Water Features

Map symbol and soil name	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Water table depth	High water table: Kind of water table	High water table: Months
					Ft		
13B:							
Zook------------	C/D	None-------	---	---	0.0-1.0	Apparent	Nov-Jul
Olmitz----------	B	None-------	---	---	>6.0	---	---
Vesser----------	C	None-------	---	---	1.0-3.0	Apparent	Nov-Jul
23C, 23C2:							
Arispe----------	C	None-------	---	---	2.0-4.0	Perched	Nov-Jul
24D, 24D2, 24E2, 24E3, 24F2:							
Shelby---------	B	None-------	---	---	>6.0	---	---
51, 51+:							
Vesser----------	C	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul
51B, 51B+:							
Vesser----------	C	None-------	---	---	1.0-3.0	Apparent	Nov-Jul
54, 54+:							
Zook------------	C/D	Occasional	Long------	Feb-Nov	0.0-1.0	Apparent	Nov-Jul
54B:							
Zook------------	C/D	None-------	---	---	0.0-1.0	Apparent	Nov-Jul
65E, 65E2, 65F, 65F2, 65G, 65G2:							
Lindley--------	C	None-------	---	---	>6.0	---	---
93D2:							
Shelby----------	B	None-------	---	---	>6.0	---	---
Adair-----------	C	None-------	---	---	1.0-3.0	Perched	Nov-Jul
94D2, 94E2:							
Mystic----------	C	None-------	---	---	1.0-3.0	Perched	Nov-Jul
Caleb-----------	B	None-------	---	---	3.0-5.0	Perched	Nov-Jul
131B, 131C, 131C2, 131D2:							
Pershing-------	C	None-------	---	---	2.0-4.0	Perched	Nov-Jul
132B, 132C, 132C2, 132D2:							
Weller---------	C	None-------	---	---	2.0-4.0	Perched	Nov-Jul
172:							
Wabash----------	D	Occasional	Long------	Nov-May	0.0-1.0	Apparent	Nov-Jul
179D2, 179E, 179E2, 179E3, 179F, 179F2, 179G2:							
Gara-----------	C	None-------	---	---	>6.0	---	---
192C2, 192D2:							
Adair-----------	C	None-------	---	---	1.0-3.0	Perched	Nov-Jul
211:							
Edina-----------	D	None-------	---	---	0.0-1.0	Apparent	Nov-Jul

Water Features--Continued

Map symbol and soil name	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Water table depth	High water table: Kind of water table	High water table: Months
					Ft		
220:							
Nodaway	B	Occasional	Brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul
222C, 222C2, 222C3, 222D2:							
Clarinda	D	None	---	---	1.0-3.0	Perched	Nov-Jul
223C2, 223D2:							
Rinda	D	None	---	---	1.0-3.0	Perched	Nov-Jul
269, 269+:							
Humeston	C/D	Occasional	Very brief	Feb-Nov	0.0-1.0	Apparent	Nov-Jul
273B, 273C:							
Olmitz	B	None	---	---	>6.0	---	---
313D2, 313E2, 313F, 313F2:							
Gosport	C	None	---	---	1.5-3.0	Perched	Nov-Jul
362:							
Haig	C/D	None	---	---	0.0-1.0	Apparent	Nov-Jul
364B:							
Grundy	C	None	---	---	1.5-3.0	Perched	Nov-Jul
423C2, 423D, 423D2:							
Bucknell	D	None	---	---	1.0-3.0	Perched	Nov-Jul
425D, 425D2:							
Keswick	C	None	---	---	1.0-3.0	Perched	Nov-Jul
430:							
Ackmore	B	Occasional	Brief	Sep-Jun	1.0-3.0	Apparent	Nov-Jul
451D2, 451E2:							
Caleb	B	None	---	---	3.0-5.0	Perched	Nov-Jul
452C, 452C2:							
Lineville	C	None	---	---	1.0-3.0	Perched	Nov-Jul
453:							
Tuskeego	C/D	Rare	---	---	0.0-1.0	Apparent	Nov-Jul
470D2:							
Lamoni	C	None	---	---	1.0-3.0	Perched	Nov-Jul
Shelby	B	None	---	---	>6.0	---	---
484:							
Lawson	D	Occasional	Long	Mar-Nov	1.0-3.0	Apparent	Nov-Jul
587, 587+:							
Chequest	C	Occasional	Long	Feb-Nov	0.0-1.0	Apparent	Nov-Jul
592C2, 592D2:							
Mystic	C	None	---	---	1.0-3.0	Perched	Nov-Jul
711:							
Nodaway	D	Occasional	Brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul
Lawson	D	Occasional	Long	Mar-Nov	1.0-3.0	Apparent	Nov-Jul

Water Features--Continued

Map symbol and soil name	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Water table depth	High water table: Kind of water table	High water table: Months
					Ft		
792C, 792C2, 792D, 792D2, 792D3:							
Armstrong------	C	None-------	---	---	1.0-3.0	Perched	Nov-Jul
822C, 822C2, 822D, 822D2:							
Lamoni---------	C	None-------	---	---	1.0-3.0	Perched	Nov-Jul
831B, 831C, 831C2:							
Pershing-------	C	None-------	---	---	2.0-4.0	Perched	Nov-Jul
894D2:							
Bucknell--------	D	None-------	---	---	1.0-3.0	Perched	Nov-Jul
Gara------------	C	None-------	---	---	>6.0	---	---
993D2:							
Gara------------	C	None-------	---	---	>6.0	---	---
Armstrong-------	C	None-------	---	---	1.0-3.0	Perched	Nov-Jul
1711:							
Nodaway---------	D	Frequent---	Brief-----	Feb-Nov	3.0-5.0	Apparent	Nov-Jul
Lawson----------	C	Frequent---	Brief-----	Mar-Nov	1.0-3.0	Apparent	Nov-Jul
5021:							
Orthents--------	---	None-------	---	---	---	---	---
5025:							
Strip mines-----	A	None-------	---	---	>6.0	---	---
5040:							
Orthents--------	---	None-------	---	---	---	---	---

Soil Features

Map symbol and soil name	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
	In				
13B:					
Zook	>60	---	High	High	Moderate.
Olmitz	>60	---	Moderate	Moderate	Moderate.
Vesser	>60	---	High	High	Moderate.
23C, 23C2:					
Arispe	>60	---	High	High	Moderate.
24D, 24D2, 24E2, 24E3, 24F2:					
Shelby	>60	---	Moderate	Moderate	Moderate.
51, 51+, 51B, 51B+:					
Vesser	>60	---	High	High	Moderate.
54, 54+, 54B:					
Zook	>60	---	High	High	Moderate.
65E, 65E2, 65F, 65F2, 65G, 65G2:					
Lindley	>60	---	Moderate	Moderate	Moderate.
93D2:					
Shelby	>60	---	Moderate	Moderate	Moderate.
Adair	>60	---	High	High	Moderate.
94D2, 94E2:					
Mystic	>60	---	High	Moderate	Moderate.
Caleb	>60	---	Moderate	Moderate	Moderate.
131B, 131C, 131C2, 131D2:					
Pershing	>60	---	High	High	Moderate.
132B, 132C, 132C2, 132D2:					
Weller	>60	---	High	High	High.
172:					
Wabash	>60	---	Moderate	High	Moderate.
179D2, 179E, 179E2, 179E3, 179F, 179F2, 179G2:					
Gara	>60	---	Moderate	Moderate	Moderate.
192C2, 192D2:					
Adair	>60	---	High	High	Moderate.
211:					
Edina	>60	---	Moderate	High	Moderate.
220:					
Nodaway	>60	---	High	Moderate	Low.

Soil Features--Continued

Map symbol and soil name	Bedrock		Potential frost action	Risk of corrosion	
	Depth	Hardness		Uncoated steel	Concrete
	In				
222C, 222C2, 222C3, 222D2: Clarinda	>60	---	High	High	Moderate.
223C2, 223D2: Rinda	>60	---	High	High	Moderate.
269, 269+: Humeston	>60	---	High	High	Moderate.
273B, 273C: Olmitz	>60	---	Moderate	Moderate	Moderate.
313D2, 313D2, 313F, 313F2: Gosport	20-40	Soft	Moderate	High	High.
362: Haig	>60	---	High	High	Moderate.
364B: Grundy	>60	---	High	High	Moderate.
423C2, 423D, 423D2: Bucknell	>60	---	Moderate	High	Moderate.
425D, 425D2: Keswick	>60	---	High	High	Moderate.
430: Ackmore	>60	---	High	High	Low.
451D2, 451E2: Caleb	>60	---	Moderate	Moderate	Moderate.
452C, 452C2: Lineville	>60	---	High	High	Moderate.
453: Tuskeego	>60	---	Moderate	High	Moderate.
470D2: Lamoni	>60	---	Moderate	High	Moderate.
Shelby	>60	---	Moderate	Moderate	Moderate.
484: Lawson	>60	---	High	Moderate	Low.
587, 587+: Chequest	>60	---	High	High	Moderate.
592C2, 592D2: Mystic	>60	---	High	Moderate	Moderate.
711: Nodaway	>60	---	High	Moderate	Low.
Lawson	>60	---	High	Moderate	Low.

Soil Features--Continued

Map symbol and soil name	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
	In				
792C, 792C2, 792D, 792D2, 792D3:					
Armstrong	>60	---	High	High	Moderate.
822C, 822C2, 822D, 822D2:					
Lamoni	>60	---	Moderate	High	Moderate.
831B, 831C, 831C2:					
Pershing	>60	---	High	High	Moderate.
894D2:					
Bucknell	>60	---	Moderate	High	Moderate.
Gara	>60	---	Moderate	Moderate	Moderate.
993D2:					
Gara	>60	---	Moderate	Moderate	Moderate.
Armstrong	>60	---	High	High	Moderate.
1711:					
Nodaway	>60	---	High	Moderate	Low.
Lawson	>60	---	High	Moderate	Low.
5021:					
Orthents.					
5025:					
Strip mines	0-4	Hard	---	---	---
5040:					
Orthents.					

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Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Backslope. The geomorphic component that forms the steepest inclined surface and principal element of many hillslopes (fig. 4). Backslopes in profile are commonly steep and linear and descend to a footslope. In terms of gradational process, backslopes are erosional forms produced mainly by mass wasting and running water.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope. A geomorphic component of hills. It consists of a concave surface at the bottom of hillslopes that is underlain by colluvial and slope-wash materials or forms a colluvial apron or wedge; a three-dimensional analog of a footslope. Distal base slope sediments commonly grade into, interfinger with, or are buried by alluvial fills.

Beach deposits. Material, such as sand and gravel, that is generally laid down parallel to an active or relict shoreline of a postglacial or glacial lake.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor

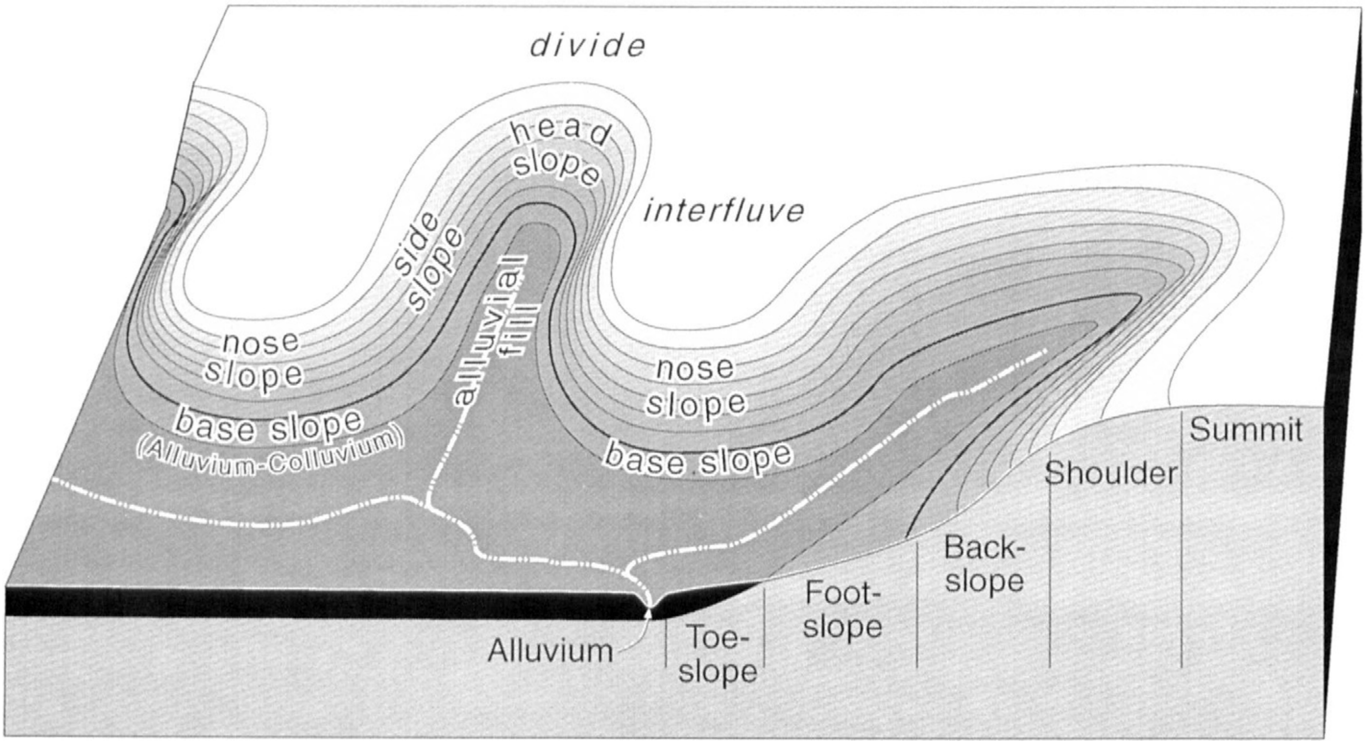


Figure 4.—Landscape relationship of geomorphic components and hillslope positions (modified after Ruhe and Walker, 1968).

formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. Any tillage and planting system in which a cover of crop residue is maintained on at least 30 percent of the surface after planting in order to reduce the hazard of water erosion; in areas where wind erosion is the primary concern, a system that maintains a cover of at least 1,000 pounds of flat residue of small grain or its equivalent during the critical erosion period.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour.

Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Delta. A body of alluvium having a surface that is nearly flat and fan shaped; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divide. (a) The line of separation, or (b) the summit area, or narrow tract of higher ground that constitutes the watershed boundary between two adjacent drainage basins; it divides the surface waters that flow naturally in one direction from those that flow in the opposite direction.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.

Well drained.—These soils have an intermediate or high water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of most field crops are affected. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted under natural conditions. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poor drainage is caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except for rice) under natural conditions.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Duff. A generally firm organic layer on the surface of

mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian deposits. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. The term is more often applied to cliffs resulting from differential erosion.

Esker. A long, narrow, sinuous, steep-sided ridge composed of irregularly stratified sand and gravel that were deposited by a subsurface stream flowing between ice walls or through ice tunnels of a retreating glacier and that were left behind when the ice melted. Eskers range from less than 1 mile to more than 100 miles in length and from 10 to 100 feet in height.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of fire fighters and equipment. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material is 35 to 60 percent flagstones, and extremely flaggy soil material is more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is generally a constructional landform consisting of sediment deposited during overflow and lateral migration of the stream.

Footslope. The geomorphic component that forms

the inner, gently inclined surface at the base of a hillslope. The surface is dominantly concave. In terms of gradational processes, a footslope is a transition zone between an upslope site of erosion (backslope) and a downslope site of deposition (toeslope).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Geomorphology. The science that treats the general configuration of the earth's surface; specifically the study of the classification, description, nature, origin, and development of landforms and their relationships to underlying structures, and the history of geologic changes as recorded by these surface features. The term is especially applied to the genetic interpretation of landforms.

Glacial drift. Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glaciofluvial deposits. Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Head slope. The concave surface at the head of a drainageway where the flow of water converges downward toward the center and contour lines form concave curves.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-chroma zones. Zones having chroma of 3 or more. Typical color in areas of iron concentrations.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 6 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Ice-walled lake plain. A relict surface marking the floor of an extinct lake basin that was formed on solid ground and surrounded by stagnant ice in a stable or unstable superglacial environment on stagnation moraines. As the ice melted the lake plain became perched above the adjacent landscape. The lake plain is well sorted, generally fine textured, stratified deposits.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not

a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Interfluve. A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways.

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Iron concentrations. High-chroma zones having a high content of iron and manganese oxide because of chemical oxidation and accumulation, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic concentration.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame. A moundlike hill of glacial drift, composed chiefly of stratified sand and gravel.

Kame moraine. An end moraine that contains numerous kames. A group of kames along the front of a stagnant glacier, commonly comprising the slumped remnants of a formerly continuous outwash plain built up over the foot of rapidly wasting or stagnant ice.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake bed. The bottom of a lake; a lake basin.

Lake plain. A nearly level surface marking the floor of an extinct lake filled by well sorted, generally fine textured, stratified deposits, commonly containing varves.

Lakeshore. A narrow strip of land in contact with or bordering a lake; especially the beach of a lake.

Lake terrace. A narrow shelf, partly cut and partly built, produced along a lakeshore in front of a scarp line of low cliffs and later exposed when the water level falls.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by the wind.

Low-chroma zones. Zones having chroma of 2 or less. Typical color in areas of iron depletions.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine. An accumulation of glacial drift in a topographic landform resulting chiefly from the direct action of glacial ice. Some types are lateral, recessional, and terminal.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

Nose slope. The projecting end of an interfluve, where contour lines connecting the opposing side slopes form convex curves around the projecting end and lines perpendicular to the contours diverge downward. Overland flow of water is divergent.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent

Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Outwash plain. An extensive area of glaciofluvial material that was deposited by meltwater streams.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Parts per million (ppm). The concentration of a substance in the soil, such as phosphorus or potassium, in one million parts of air-dried soil on a weight per weight basis.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment. A thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher lying areas of the erosion surface.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Extremely slow	less than 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

Phosphorus. The amount of phosphorus available to plants at a depth of 30 to 42 inches is expressed in parts per million and based on the weighted average of air-dried soil samples. Terms describing the amount of available phosphorus are:

Very low	less than 7.5 ppm
Low	7.5 to 13.0 ppm
Medium	13.0 to 22.5 ppm
High	more than 22.5 ppm

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitted outwash plain. An outwash plain marked by many irregular depressions, such as kettles, shallow pits, and potholes, which formed by melting of incorporated ice masses; many are found in Wisconsin and Minnesota.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plateau. An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Potassium. The amount of potassium available to plants at a depth of 12 to 24 inches is expressed in parts per million and based on the weighted average of air-dried soil samples. Terms describing the amount of available potassium are:

Very low	less than 50 ppm
Low	50 to 79 ppm
Medium	79 to 125 ppm
High	more than 125 ppm

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Burning an area under conditions of weather and soil moisture and at the time of day that will result in the intensity of heat and spread required to accomplish specific forest management, wildlife, grazing, or fire hazard reduction purposes.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	less than 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs the growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saprolite. Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder. The hillslope position that forms the uppermost inclined surface near the top of a hillslope. It comprises the transition zone from backslope to summit. The surface is dominantly convex in profile and erosional in orgin.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Side slope. The slope bounding a drainageway and lying between the drainageway and the adjacent interfluve. It is generally linear along the slope width, and overland flow is parallel down the slope.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Sloughed till. Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, on glacial outwash, or on a glaciolacustrine deposit.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stagnation moraine. A body of drift released by the melting of a glacier that ceased flowing. Commonly but not always occurs near ice margins; composed of till, ice-contact stratified drift, and small areas of glacial lake sediment. Typical landforms are knob-and-kettle topography, locally including ice-walled lake plains.

Stone line. A concentration of rock fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are: *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter or loosen a layer that restricts roots.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summit. The topographically highest position of a hillslope profile and exhibiting a nearly level surface. A general term for the top, or highest level, of a landform such as a hill, mountain, or tableland. It usually refers to a high interfluve area of gentler slope that is flanked by steeper hillslopes, for example, mountain fronts or tableland escarpments.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Swale. A slight depression in the midst of generally level land. A shallow depression in an undulating ground moraine due to uneven glacial deposition.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances. It commonly is a massive, arcuate ridge or complex of ridges underlain by till and other types of drift.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Till plain. An extensive area of nearly level to undulating or gently sloping soils that are underlain by till or consist of till. Slopes are 0 to 6 percent.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The outermost inclined surface at the base of a hill. Toeslopes are commonly gentle and linear in profile.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as salts, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

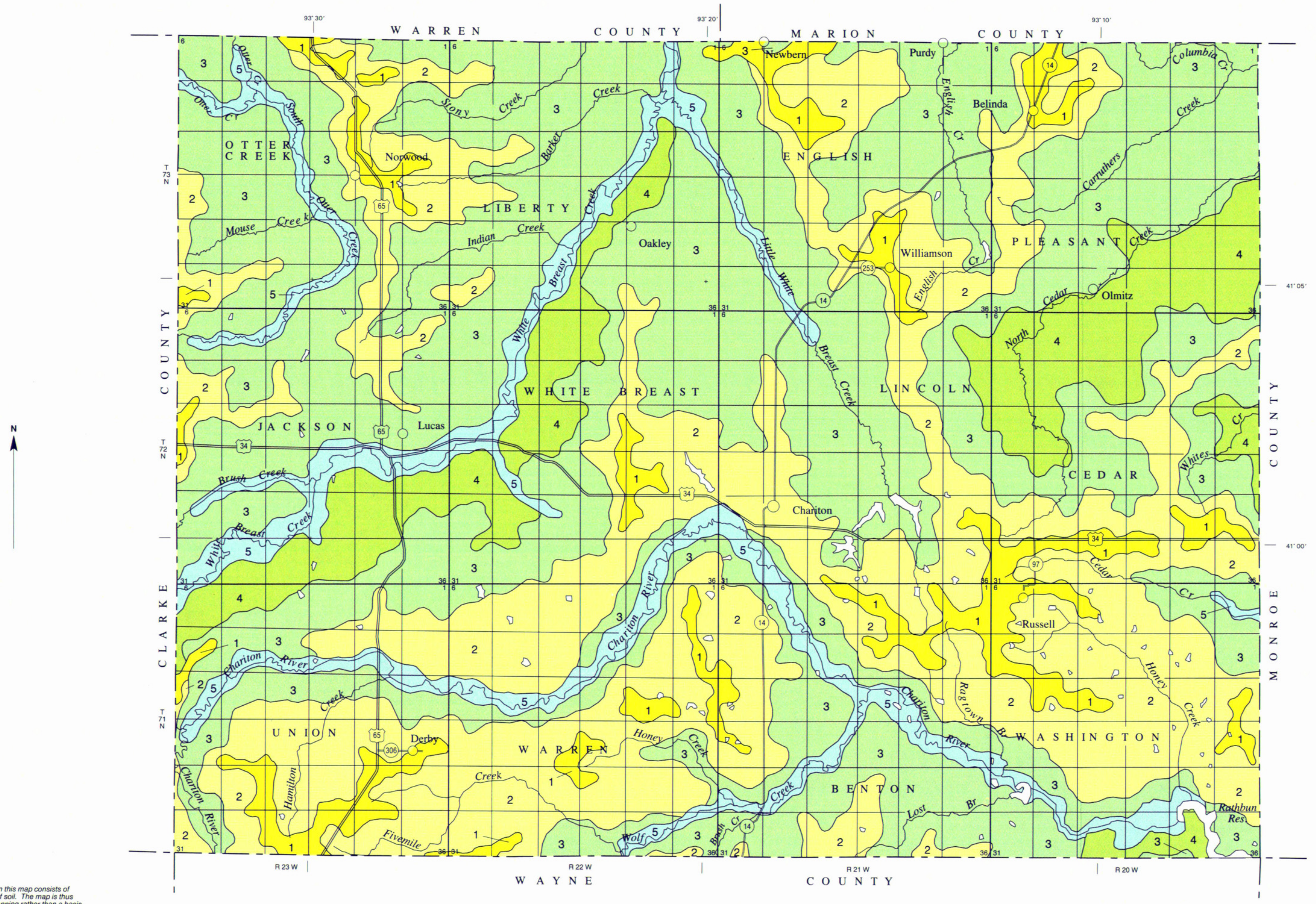
Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The uprooting and tipping over of trees by the wind.

NRCS Accessibility Statement



Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SOIL LEGEND*

1 Grundy-Haig-Arispe association

2 Arispe-Lamoni-Shelby association

3 Gara-Pershing-Armstrong association

4 Lindley-Keswick-Weller association

5 Nodaway-Zook-Lawson association

*The units on this legend are described in the text under the heading "General Soil Map Units."

Compiled 1991

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
in cooperation with
IOWA AGRICULTURE AND HOME ECONOMICS EXPERIMENT STATION
COOPERATIVE EXTENSION SERVICE,
IOWA STATE UNIVERSITY, and the
DIVISION OF SOIL CONSERVATION,
IOWA DEPARTMENT OF AGRICULTURE
and LAND STEWARDSHIP

GENERAL SOIL MAP

LUCAS COUNTY, IOWA

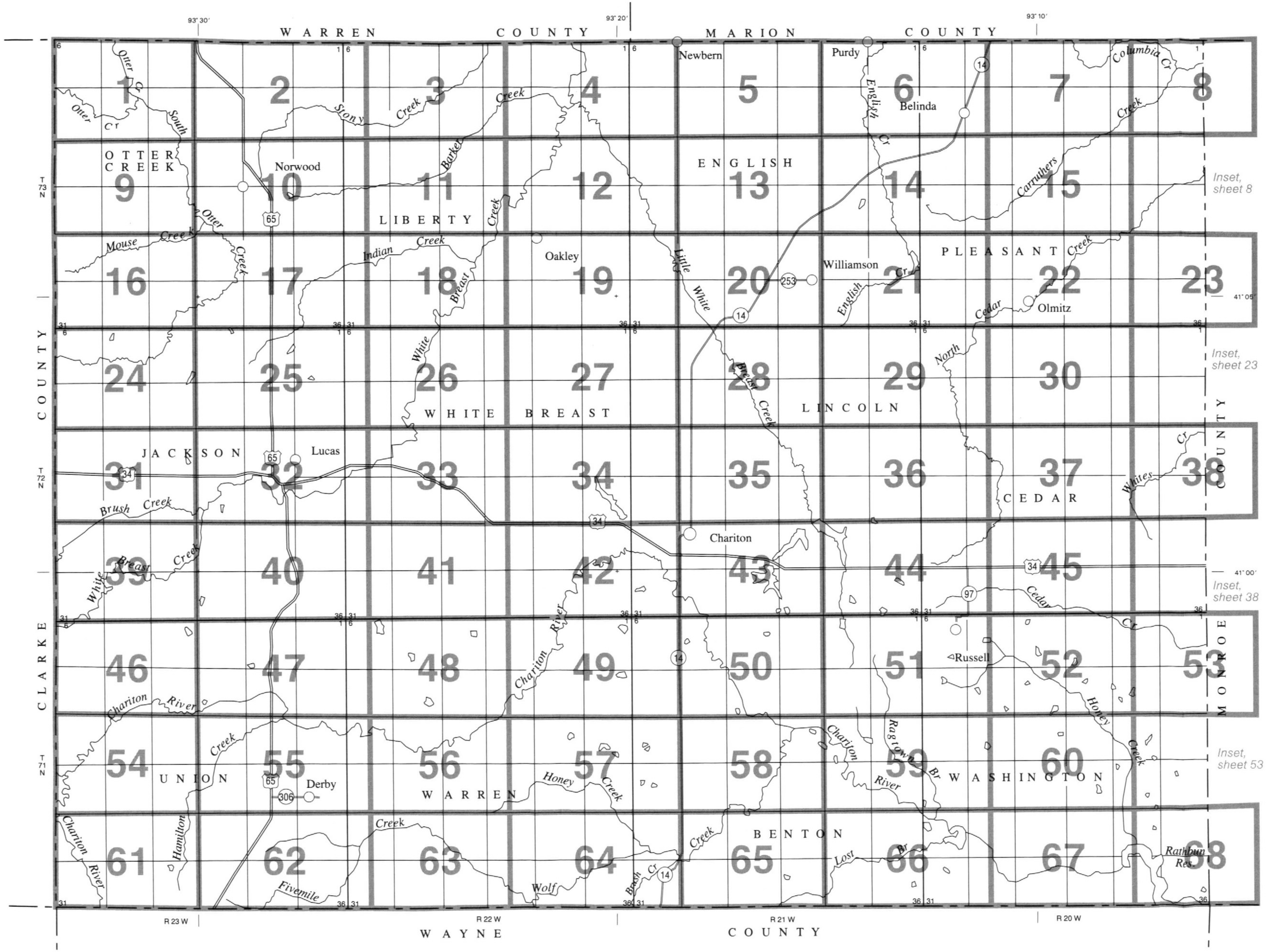
Scale 1:126720

1 0 1 2 3

MILES

1 0 1 2 3 4 5 6

KILOMETERS



Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

Original text from each individual map sheet read:
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Base maps are prepared from 1983 -1984 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS
LUCAS COUNTY, IOWA

Scale 1:126720

1 0 1 2 3
MILES

1 0 1 2 3 4 5 6
KILOMETERS

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 following the slope letter indicates that the soil is moderately eroded, and 3 indicates that the soil is severely eroded.

SYMBOL	NAME
13B	Zook-Olmitz-Vesser complex, 0 to 5 percent slopes
23C	Arispe silty clay loam, 5 to 9 percent slopes
23C2	Arispe silty clay loam, 5 to 9 percent slopes, moderately eroded
24D	Shelby clay loam, 9 to 14 percent slopes
24D2	Shelby clay loam, 9 to 14 percent slopes, moderately eroded
24E2	Shelby clay loam, 14 to 18 percent slopes, moderately eroded
24E3	Shelby clay loam, 14 to 18 percent slopes, severely eroded
24F2	Shelby clay loam, 18 to 25 percent slopes, moderately eroded
51	Vesser silt loam, 0 to 2 percent slopes
51+	Vesser silt loam, 0 to 2 percent slopes, overwash
51B	Vesser silt loam, 2 to 5 percent slopes
51B+	Vesser silt loam, 2 to 5 percent slopes, overwash
54	Zook silty clay loam, 0 to 2 percent slopes
54+	Zook silt loam, 0 to 2 percent slopes, overwash
54B	Zook silty clay loam, 2 to 5 percent slopes
65E	Lindley loam, 14 to 18 percent slopes
65E2	Lindley loam, 14 to 18 percent slopes, moderately eroded
65F	Lindley loam, 18 to 25 percent slopes
65F2	Lindley loam, 18 to 25 percent slopes, moderately eroded
65G	Lindley loam, 25 to 40 percent slopes
65G2	Lindley loam, 25 to 40 percent slopes, moderately eroded
93D2	Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded
94D2	Mystic-Caleb complex, 9 to 14 percent slopes, moderately eroded
94E2	Mystic-Caleb complex, 14 to 18 percent slopes, moderately eroded
131B	Pershing silt loam, 2 to 5 percent slopes
131C	Pershing silt loam, 5 to 9 percent slopes
131C2	Pershing silty clay loam, 5 to 9 percent slopes, moderately eroded
131D2	Pershing silty clay loam, 9 to 14 percent slopes, moderately eroded
132B	Weller silt loam, 2 to 5 percent slopes
132C	Weller silt loam, 5 to 9 percent slopes
132C2	Weller silty clay loam, 5 to 9 percent slopes, moderately eroded
132D2	Weller silty clay loam, 9 to 14 percent slopes, moderately eroded
172	Wabash silty clay, 0 to 2 percent slopes
179D2	Gara clay loam, 9 to 14 percent slopes, moderately eroded
179E	Gara loam, 14 to 18 percent slopes
179E2	Gara clay loam, 14 to 18 percent slopes, moderately eroded
179E3	Gara clay loam, 14 to 18 percent slopes, severely eroded
179F	Gara loam, 18 to 25 percent slopes
179F2	Gara clay loam, 18 to 25 percent slopes, moderately eroded
179G2	Gara clay loam, 25 to 40 percent slopes, moderately eroded
192C2	Adair clay loam, 5 to 9 percent slopes, moderately eroded
192D2	Adair clay loam, 9 to 14 percent slopes, moderately eroded
211	Edina silt loam, depressional, 0 to 1 percent slopes
220	Nodaway silt loam, 0 to 2 percent slopes
222C	Clarinda silty clay loam, 5 to 9 percent slopes
222C2	Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded
222C3	Clarinda silty clay loam, 5 to 9 percent slopes, severely eroded
222D2	Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded

SYMBOL	NAME
223C2	Rinda silty clay loam, 5 to 9 percent slopes, moderately eroded
223D2	Rinda silty clay loam, 9 to 14 percent slopes, moderately eroded
269	Humeston silty clay loam, 0 to 2 percent slopes
269+	Humeston silt loam, 0 to 2 percent slopes, overwash
273B	Olmitz loam, 2 to 5 percent slopes
273C	Olmitz loam, 5 to 9 percent slopes
313D2	Gosport silty clay loam, 9 to 14 percent slopes, moderately eroded
313E2	Gosport silty clay loam, 14 to 18 percent slopes, moderately eroded
313F	Gosport silt loam, 18 to 25 percent slopes
313F2	Gosport silty clay loam, 18 to 25 percent slopes, moderately eroded
362	Haig silt loam, 0 to 2 percent slopes
364B	Grundy silty clay loam, 2 to 5 percent slopes
423C2	Bucknell silty clay loam, 5 to 9 percent slopes, moderately eroded
423D	Bucknell silty clay loam, 9 to 14 percent slopes
423D2	Bucknell silty clay loam, 9 to 14 percent slopes, moderately eroded
425D	Keswick loam, 9 to 14 percent slopes
425D2	Keswick clay loam, 9 to 14 percent slopes, moderately eroded
430	Ackmore silt loam, 0 to 2 percent slopes
451D2	Caleb loam, 9 to 14 percent slopes, moderately eroded
451E2	Caleb loam, 14 to 18 percent slopes, moderately eroded
452C	Lineville silt loam, 5 to 9 percent slopes
452C2	Lineville silt loam, 5 to 9 percent slopes, moderately eroded
453	Tuskeego silt loam, 0 to 2 percent slopes
470D2	Lamoni-Shelby complex, 9 to 14 percent slopes, moderately eroded
484	Lawson silt loam, 0 to 2 percent slopes
587	Chequest silty clay loam, 0 to 2 percent slopes
587+	Chequest silt loam, 0 to 2 percent slopes, overwash
592C2	Mystic clay loam, 5 to 9 percent slopes, moderately eroded
592D2	Mystic clay loam, 9 to 14 percent slopes, moderately eroded
711	Nodaway-Lawson complex, 0 to 2 percent slopes
792C	Armstrong loam, 5 to 9 percent slopes
792C2	Armstrong clay loam, 5 to 9 percent slopes, moderately eroded
792D	Armstrong loam, 9 to 14 percent slopes
792D2	Armstrong clay loam, 9 to 14 percent slopes, moderately eroded
792D3	Armstrong clay loam, 9 to 14 percent slopes, severely eroded
822C	Lamoni silty clay loam, 5 to 9 percent slopes
822C2	Lamoni silty clay loam, 5 to 9 percent slopes, moderately eroded
822D	Lamoni silty clay loam, 9 to 14 percent slopes
822D2	Lamoni silty clay loam, 9 to 14 percent slopes, moderately eroded
831B	Pershing silt loam, bench, 2 to 5 percent slopes
831C	Pershing silt loam, bench, 5 to 9 percent slopes
831C2	Pershing silty clay loam, bench, 5 to 9 percent slopes, moderately eroded
894D2	Bucknell-Gara complex, 9 to 14 percent slopes, moderately eroded
993D2	Gara-Armstrong complex, 9 to 14 percent slopes, moderately eroded
1711	Nodaway-Lawson complex, channeled, 0 to 2 percent slopes
5021	Orthents, hilly
5025	Strip mines, dumps
5040	Orthents, loamy

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- County or parish
- Reservation (national forest or park, state forest or park, and large airport)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK
1 890 000 FEET

LAND DIVISION CORNER (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads

ROAD EMBLEM & DESIGNATIONS

- Federal — 287
- State — 52

RAILROAD

LEVEES

- Without road
- With road

DAMS

- Large (to scale)
- Medium or Small (Named where applicable)

PITS

- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban area) (occupied)
- Church
- School

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Drainage end
- Canals or ditches
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial
- Intermittent

MISCELLANEOUS WATER FEATURES

- Sewage lagoon — S.L.
- Marsh or swamp
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 23C2 364B

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

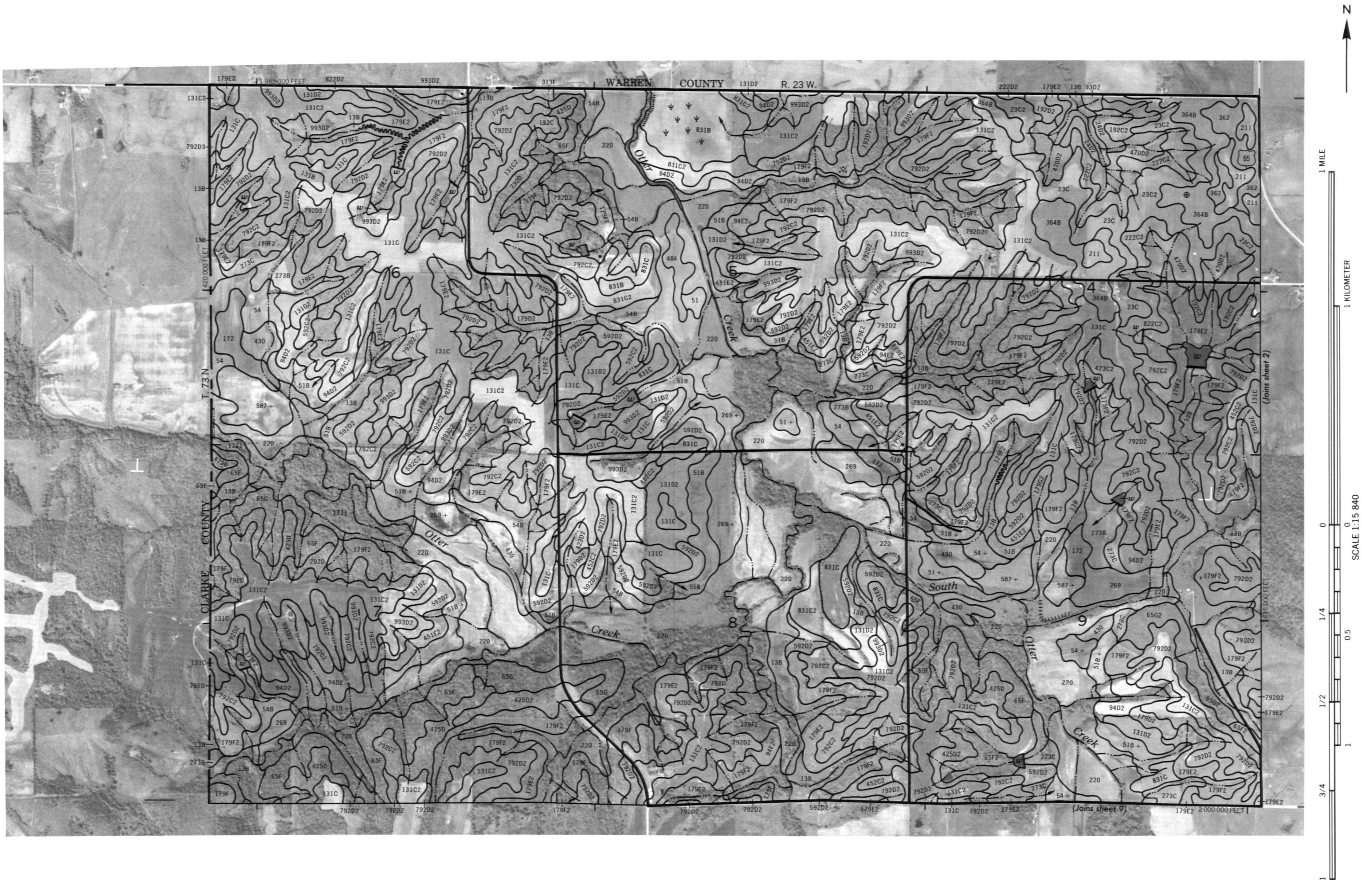
SHORT STEEP SLOPE

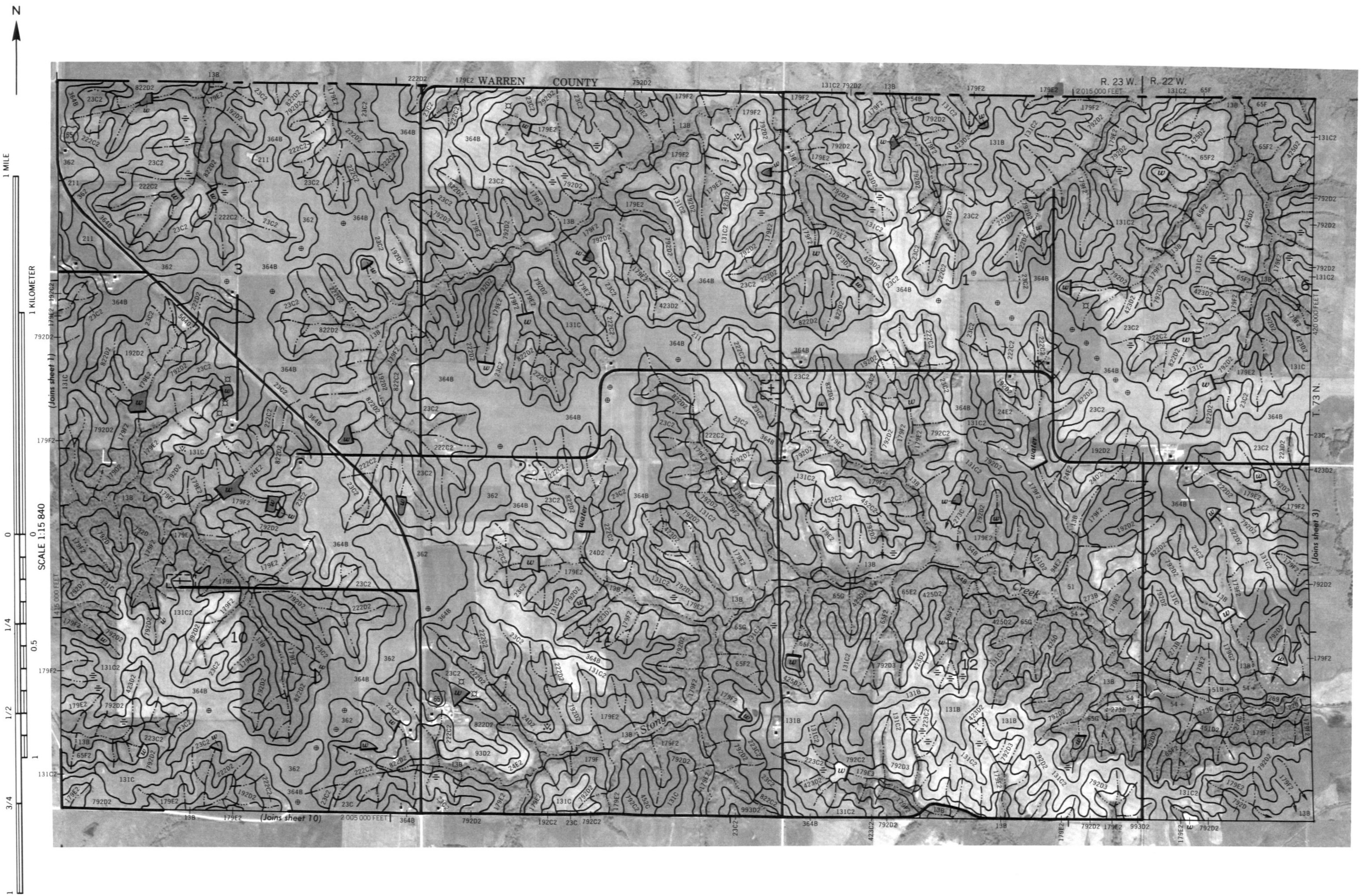
GULLY

SOIL SAMPLE (normally not shown)

MISCELLANEOUS (each symbol represents 2 acres or less)

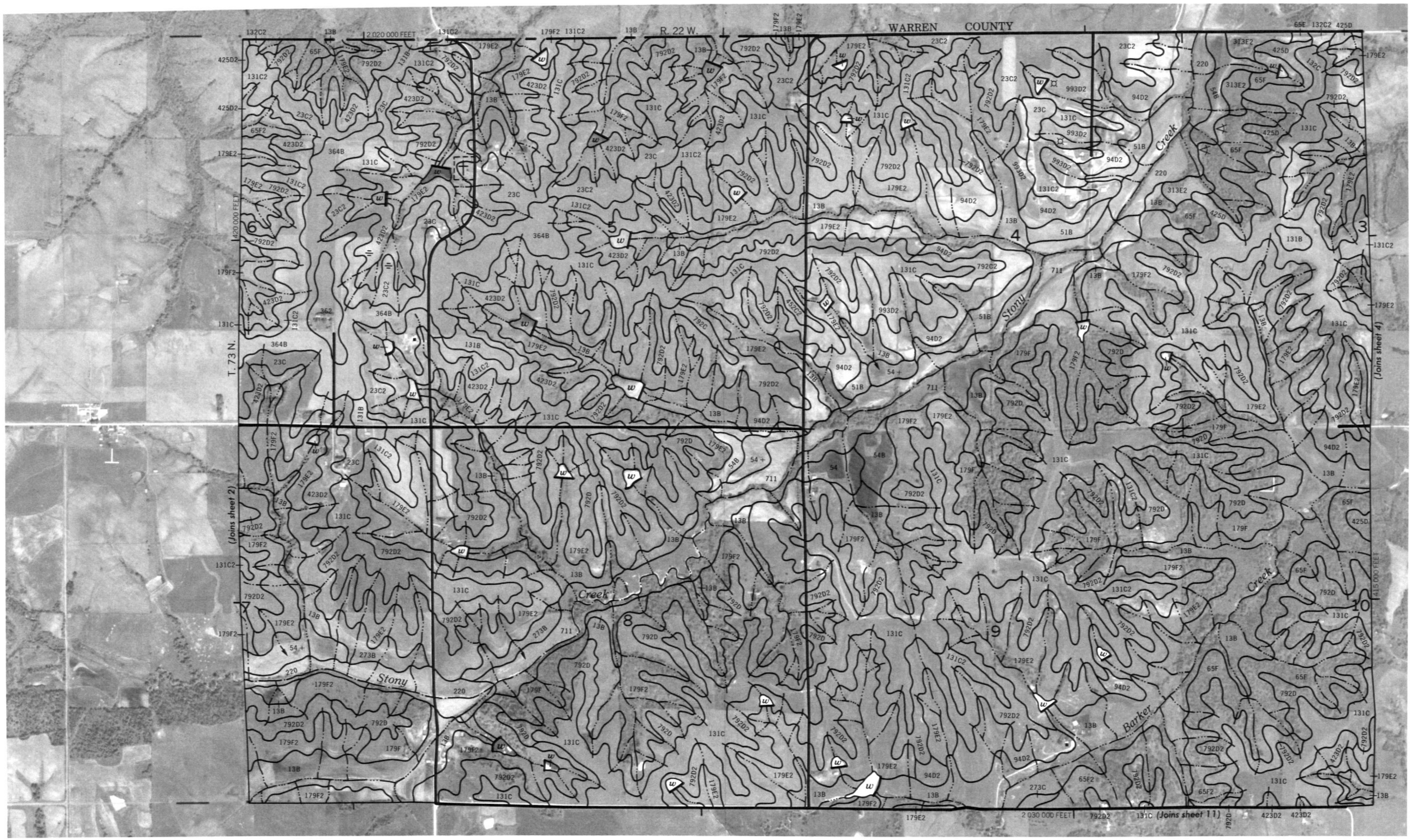
- Rock outcrop (includes sandstone and shale)
- Sandy spot
- Severely eroded spot
- Gray clay spot
- Red clay spot
- Glacial till spot
- Spot of Gosport soil
- Spot of Edina soil
- Spot of Caleb soil

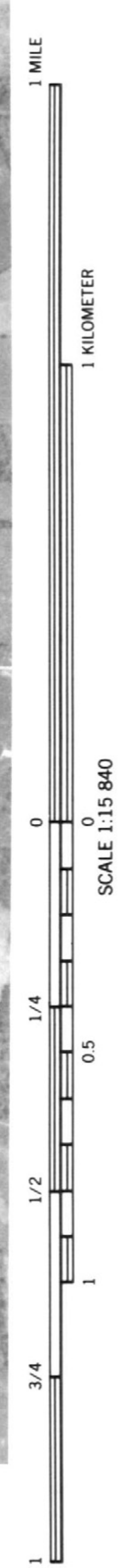

1
N
WARREN COUNTY
R. 23 W.
T. 73 N.
CLARKE COUNTY
1 985 000 FEET
420 000 FEET
2 000 000 FEET
Otter Creek
South Otter Creek
(Joins sheet 2)
(Joins sheet 9)
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0.5

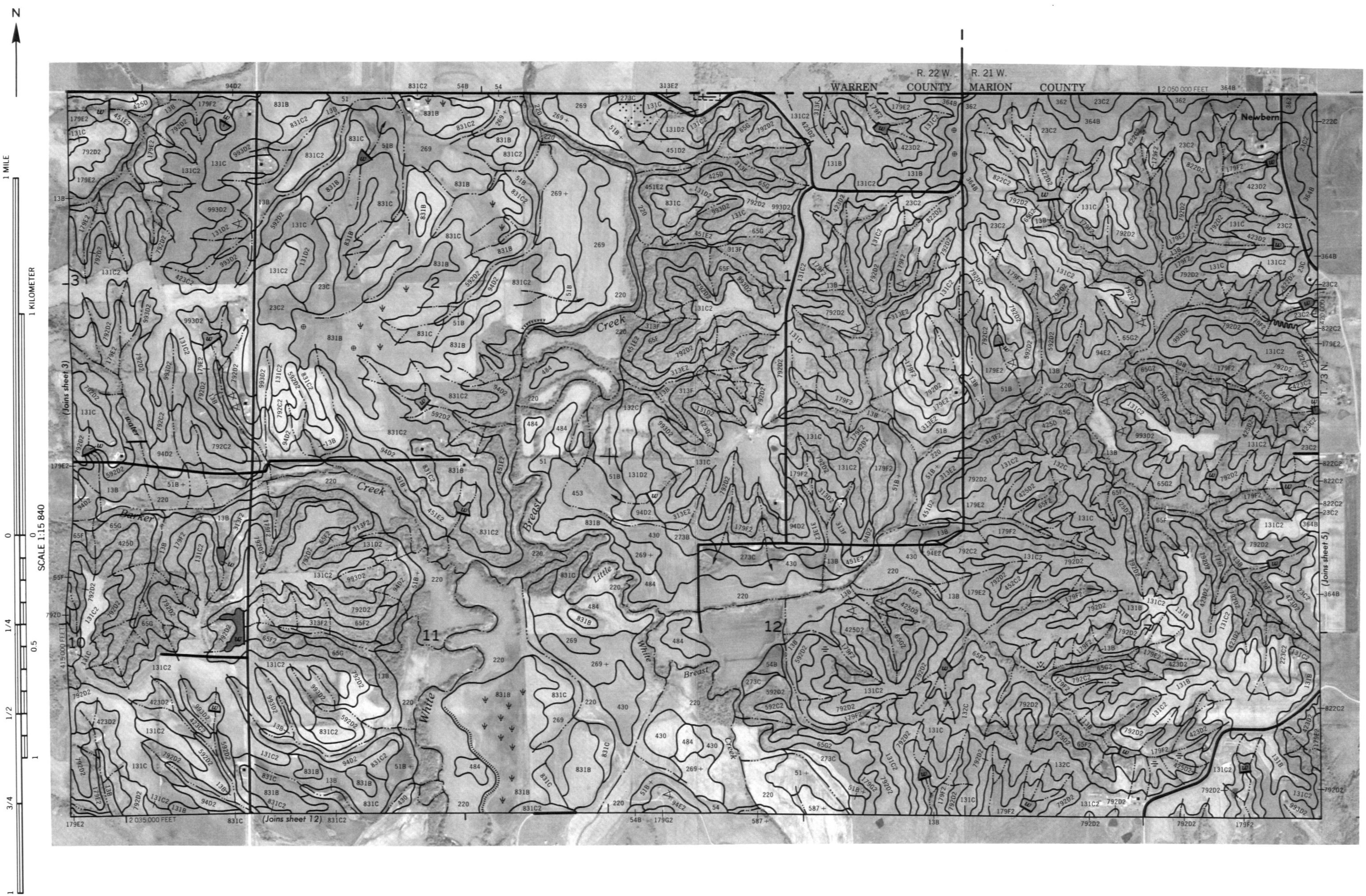

N
1 MILE
1 KILOMETER
SCALE 1:15 840
WARREN COUNTY
R. 23 W.
R. 22 W.
T. 73 N.
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 10)
2 015 000 FEET
2 005 000 FEET
420 000 FEET
415 000 FEET
Stony Creek

3

N

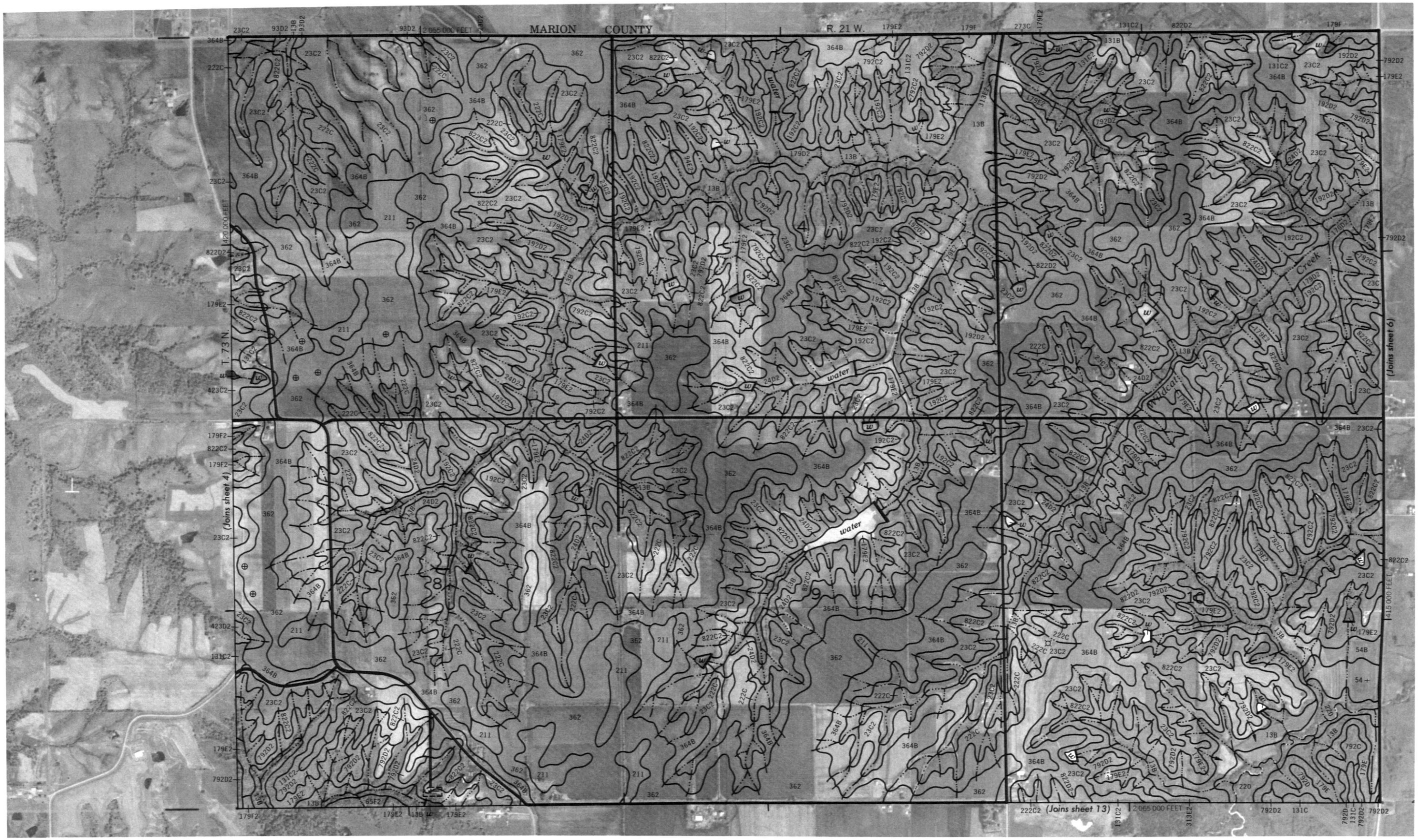

WARREN COUNTY
R. 22 W.
T. 73 N.
2 020 000 FEET
2 030 000 FEET
420 000 FEET
415 000 FEET
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 11)
Stony Creek
Stony Creek
Barker Creek
3
4
5
6
8
9
10


1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1


N
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1
R. 22 W.
R. 21 W.
WARREN COUNTY
MARION COUNTY
2 050 000 FEET
Newbern
T. 73 N.
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 12)
2 035 000 FEET
415 000 FEET
Parker
Creek
Breast
Little
White
Breast
Creek
1
2
3
6
7
10
11
12

5

N



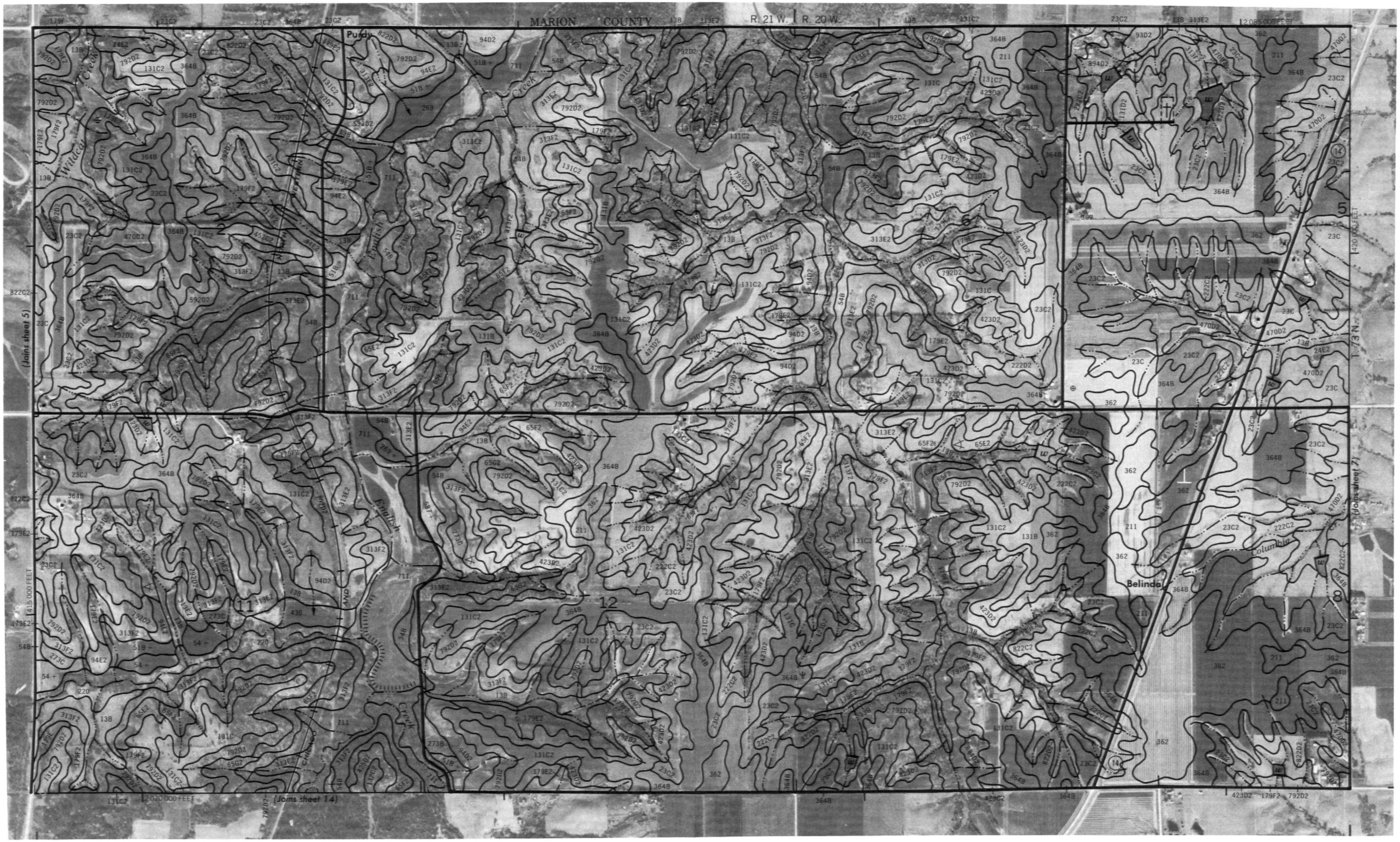
1 MILE
1 KILOMETER
SCALE 1:15 840
0 1/4 1/2 3/4 1
0 0.5 1

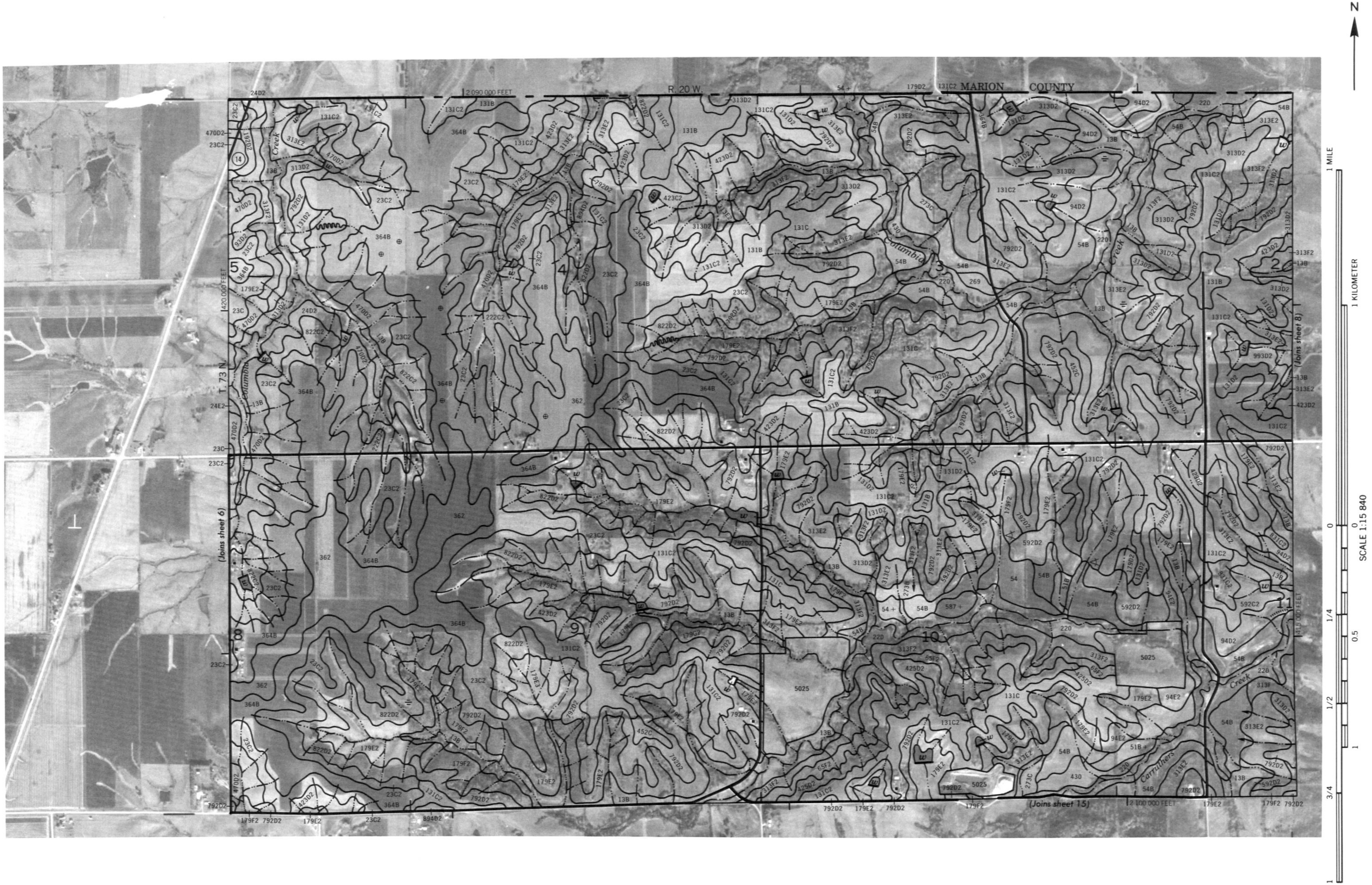
N

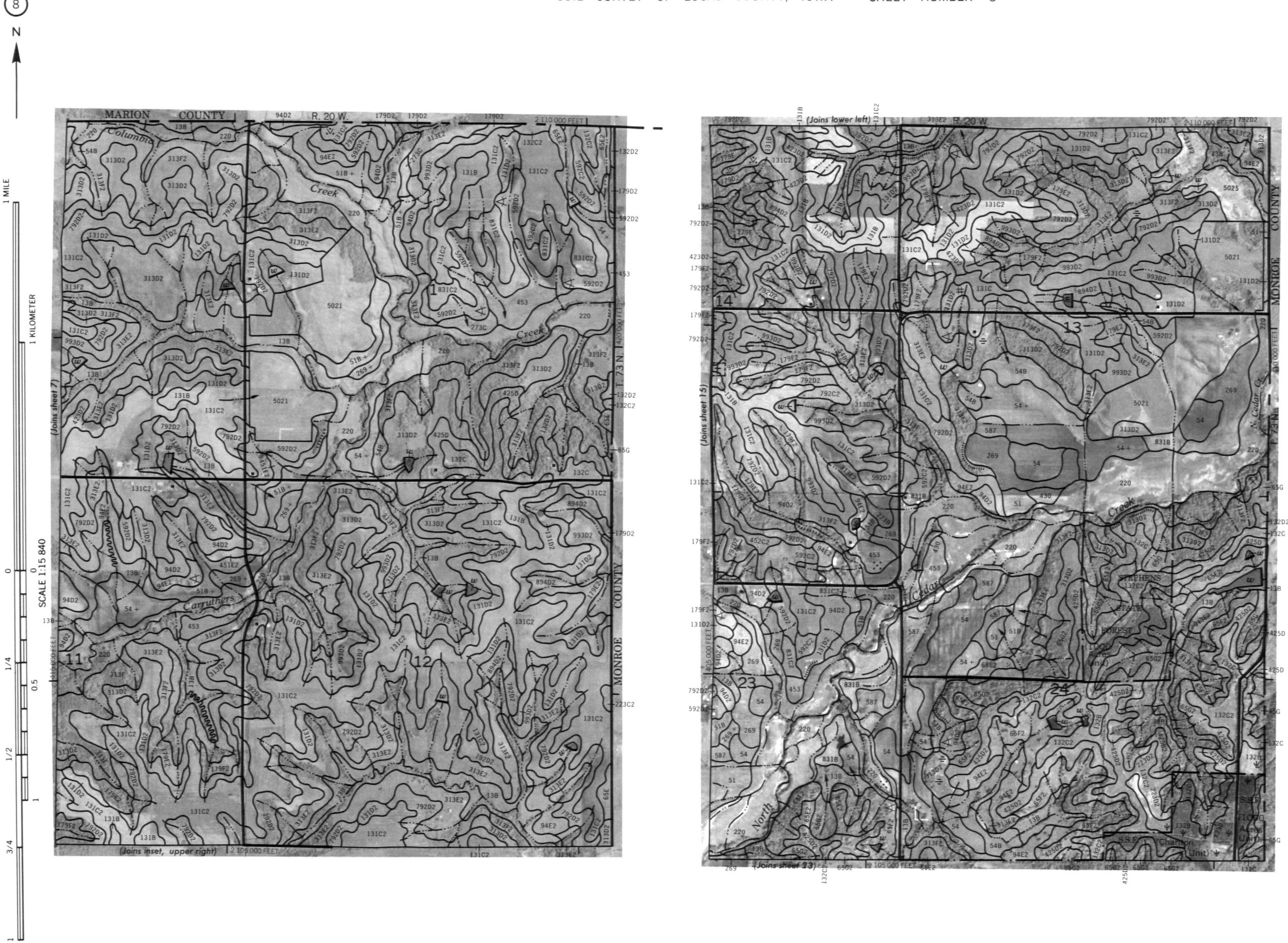
1 MILE

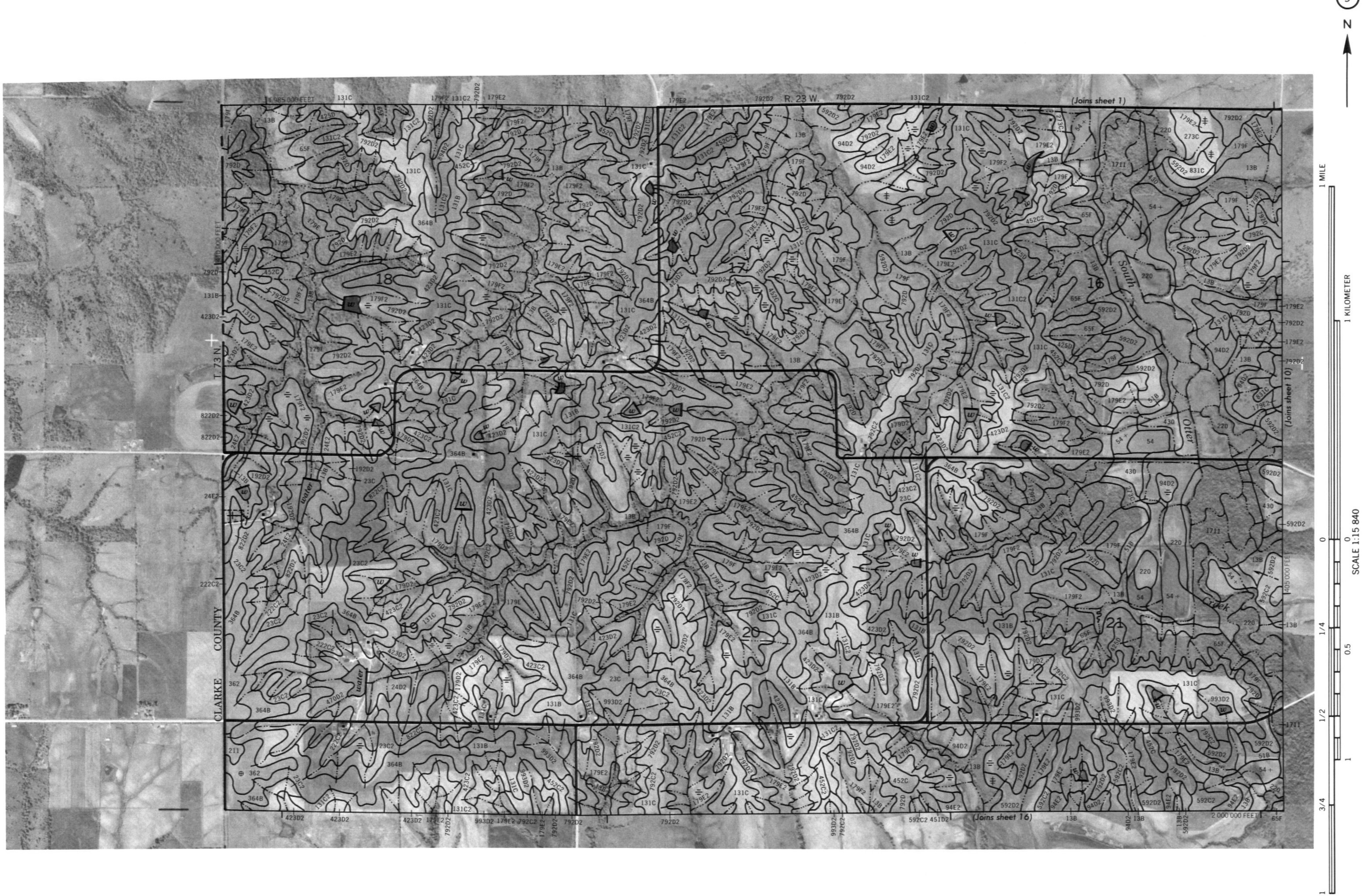
1 KILOMETER

SCALE 1:15 840

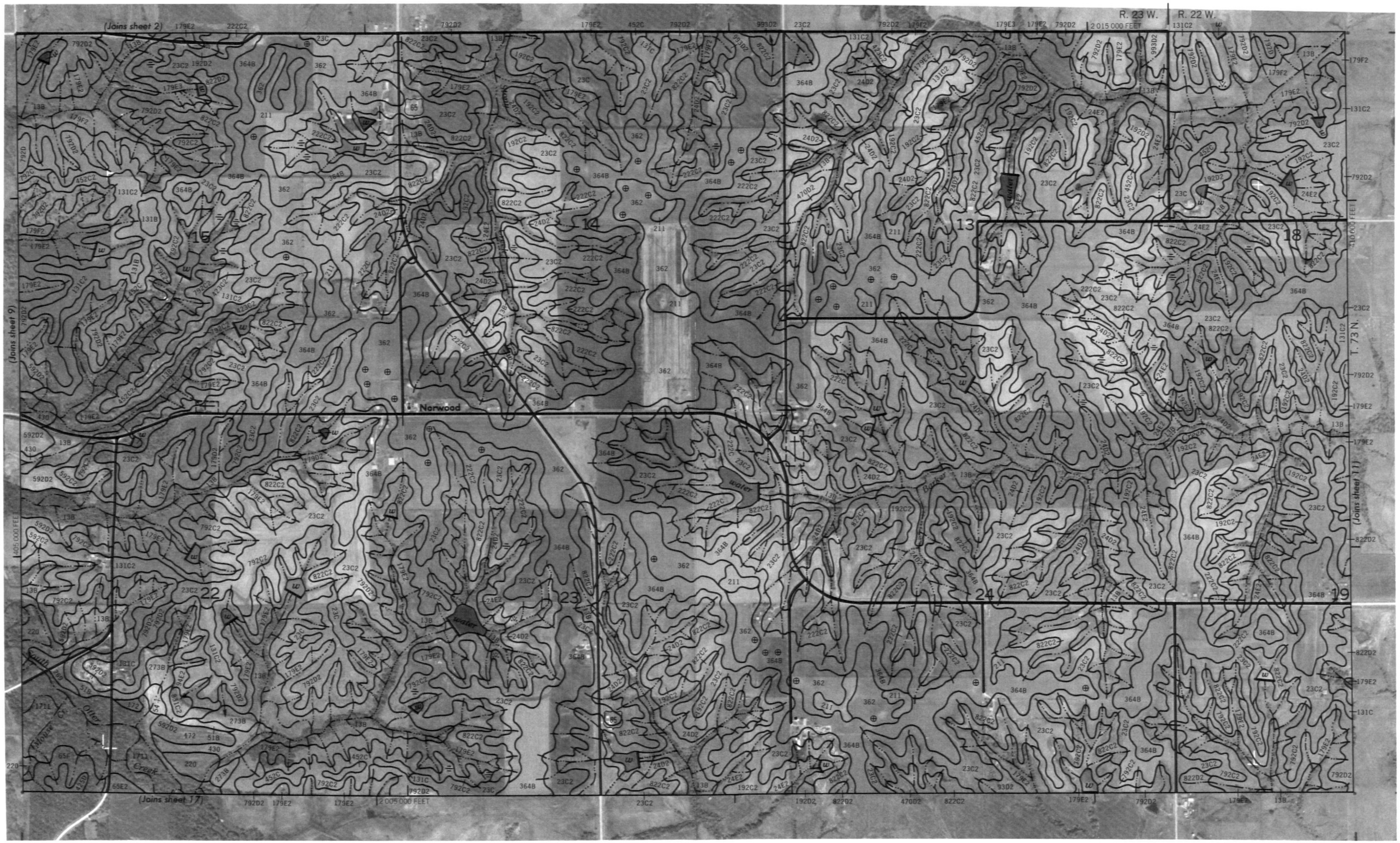



N
MARION COUNTY
R. 20 W.
T. 73 N.
2 090 000 FEET
2 100 000 FEET
420 000 FEET
(Joins sheet 6)
(Joins sheet 8)
(Joins sheet 15)
Columbia Creek
Carruthers Creek
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0.5


8
N
1 MILE
1 KILOMETER
SCALE 1:15 840
MARION COUNTY
R. 20 W.
T. 73 N.
MONROE COUNTY
(Joins sheet 7)
(Joins inset, upper right)
(Joins lower left)
(Joins sheet 15)
(Joins sheet 23)
Columbia
Creek
Carruthers
Cedar
North
N. Cedar Cr.
STEPHENS STATE FOREST
S.S.F. (Chariton Unit)
2 110 000 FEET
2 105 000 FEET
420 000 FEET
415 000 FEET
410 000 FEET
405 000 FEET

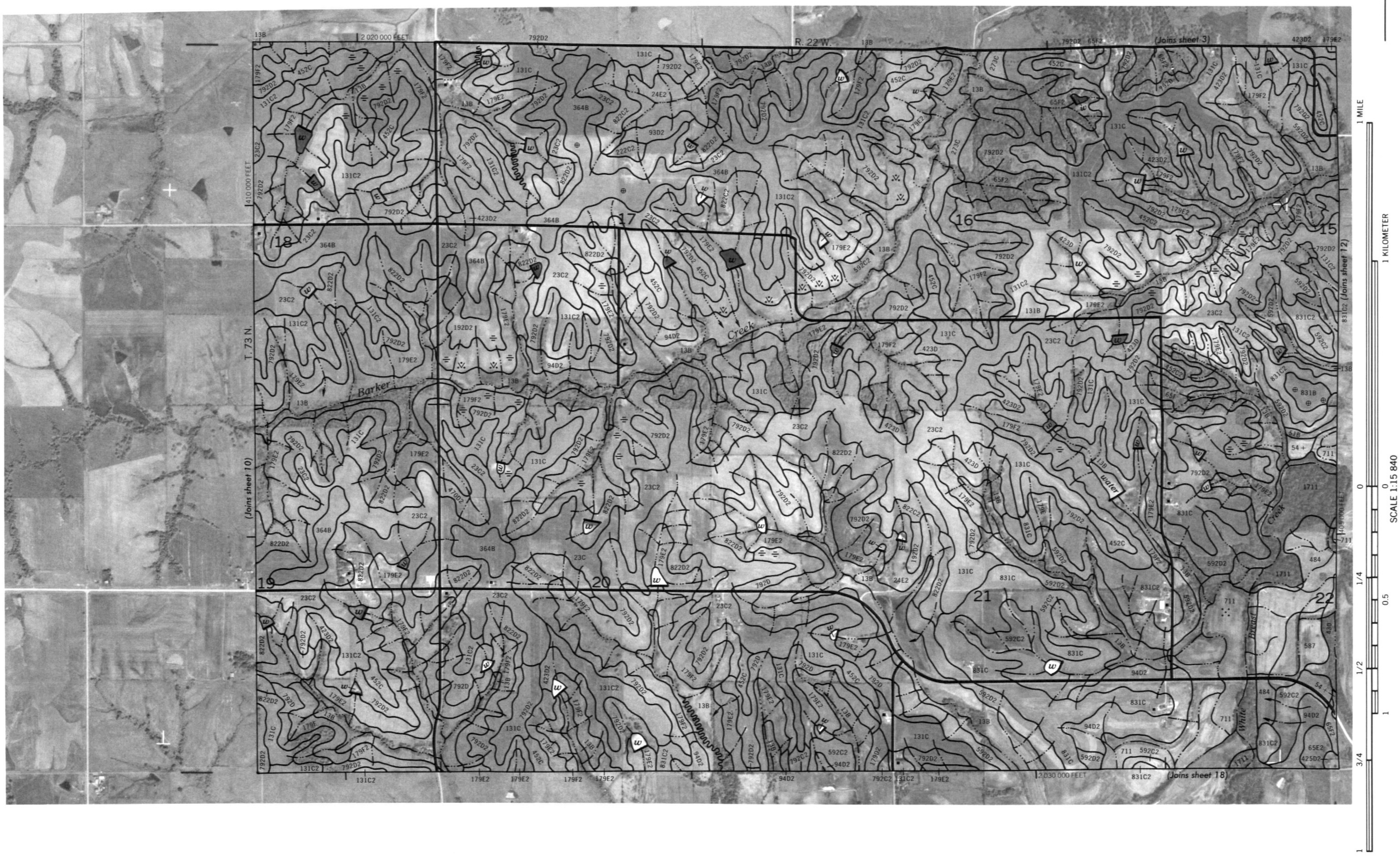

9
N
R. 23 W.
T. 73 N.
(Joins sheet 1)
(Joins sheet 10)
(Joins sheet 16)
CLARKE COUNTY
South
Otter
Creek
16
17
18
19
20
21
water
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0.5
1

N

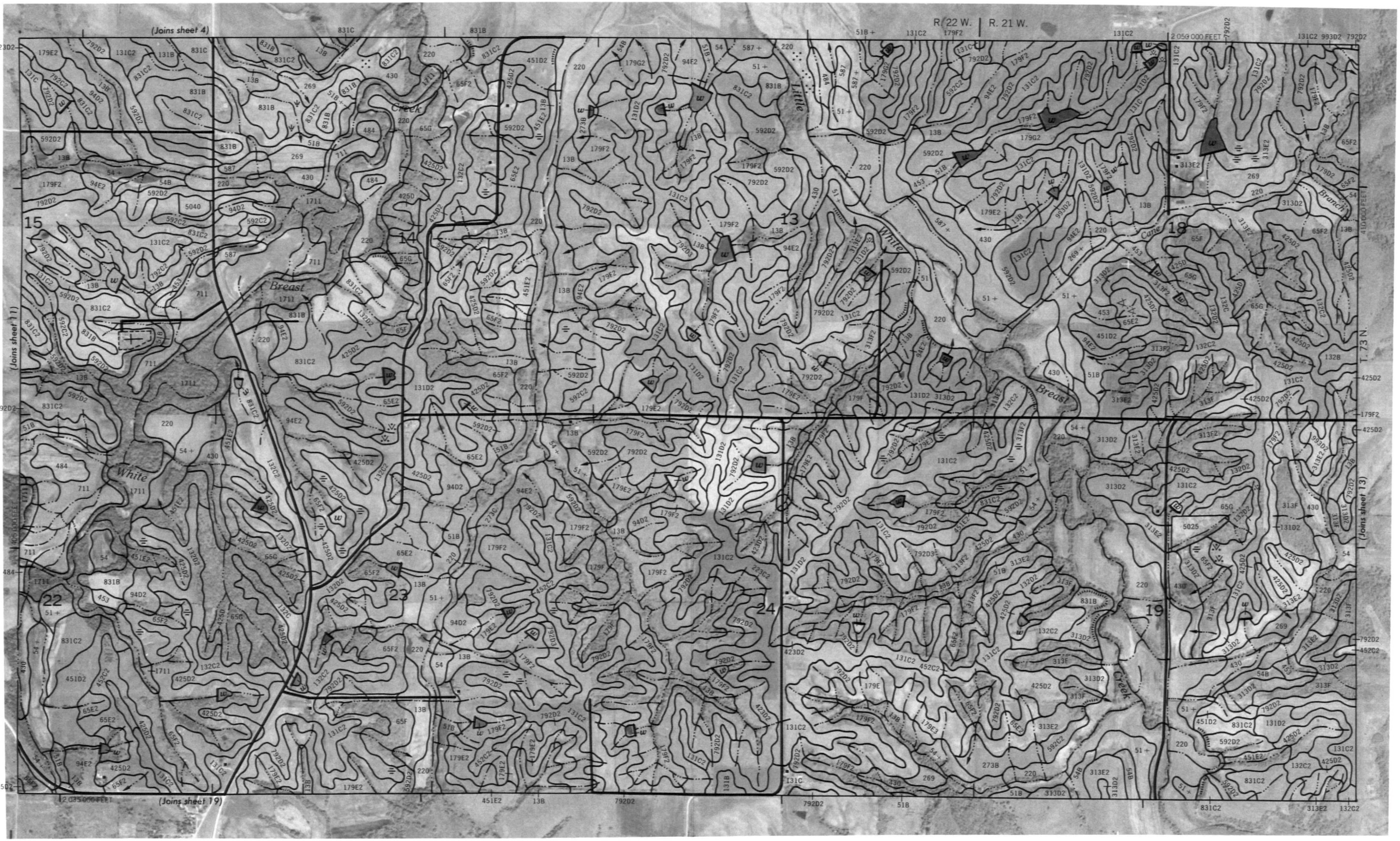


1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1

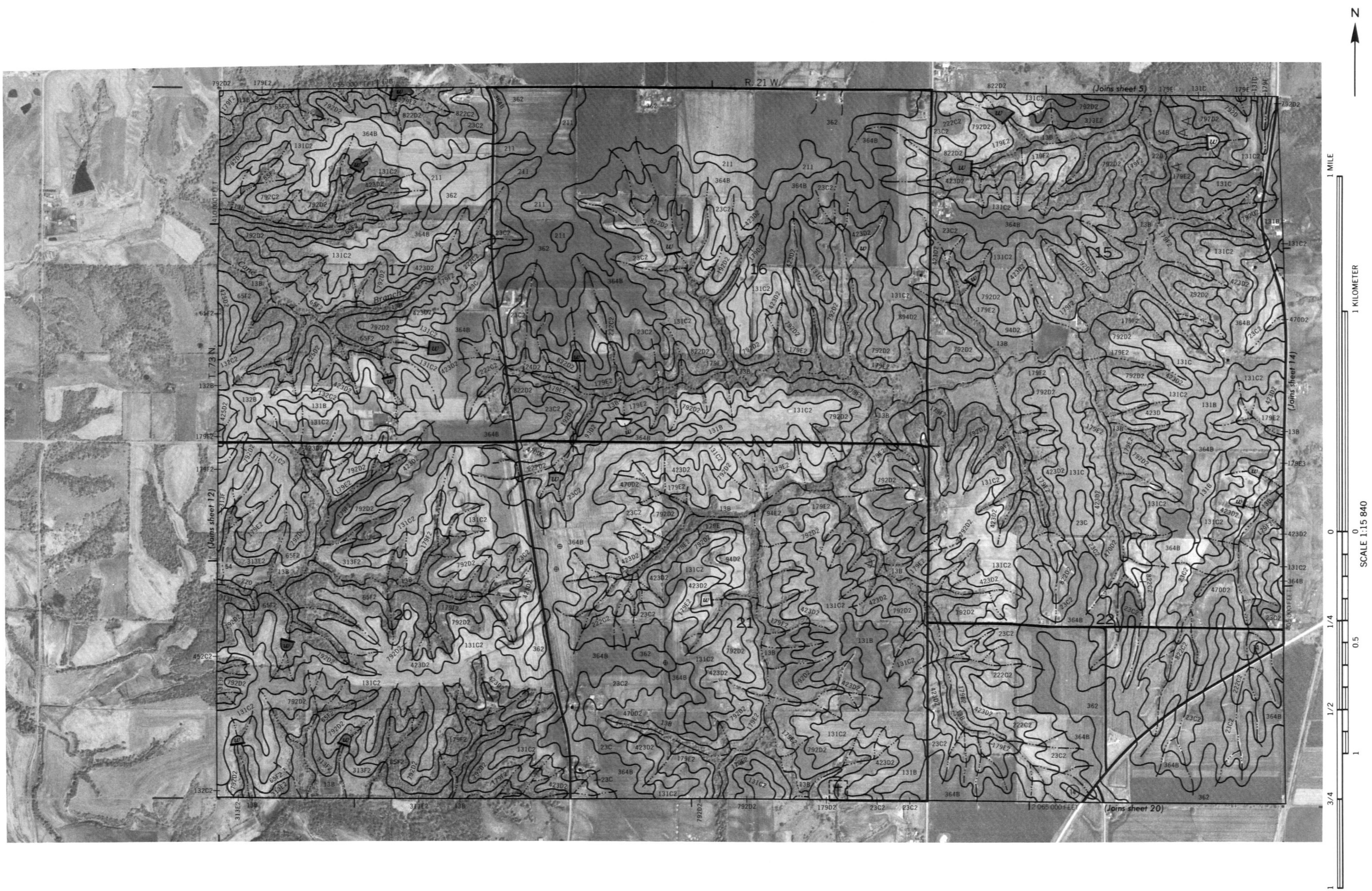
LUCAS COUNTY, IOWA NO. 11



N

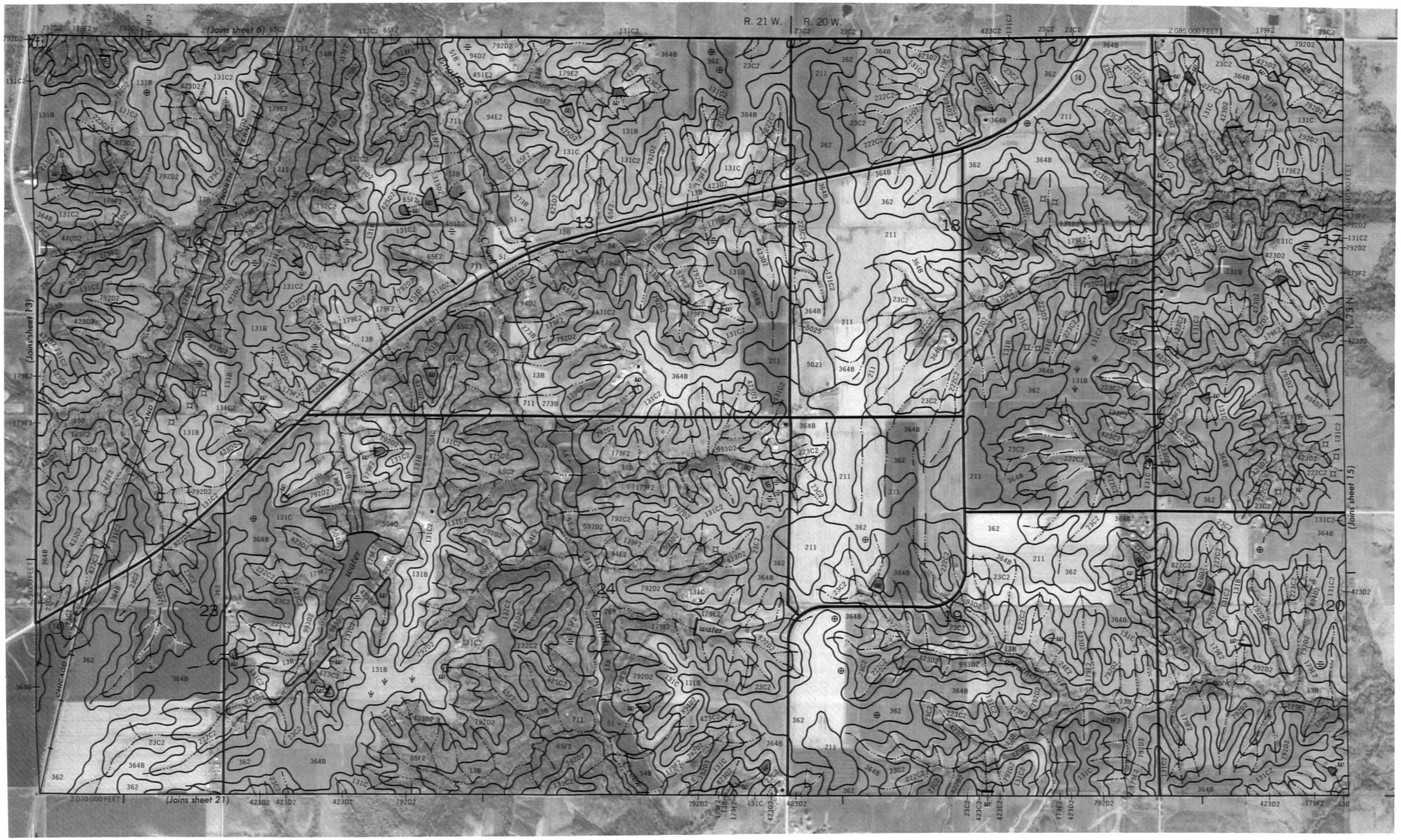


1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1


N
R. 21 W.
T. 73 N.
(Joins sheet 5)
(Joins sheet 12)
(Joins sheet 14)
(Joins sheet 20)
2 055 000 FEET
2 065 000 FEET
410 000 FEET
400 000 FEET
17
16
15
20
21
22
Cane
Branch
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0.5

14

N



1 MILE

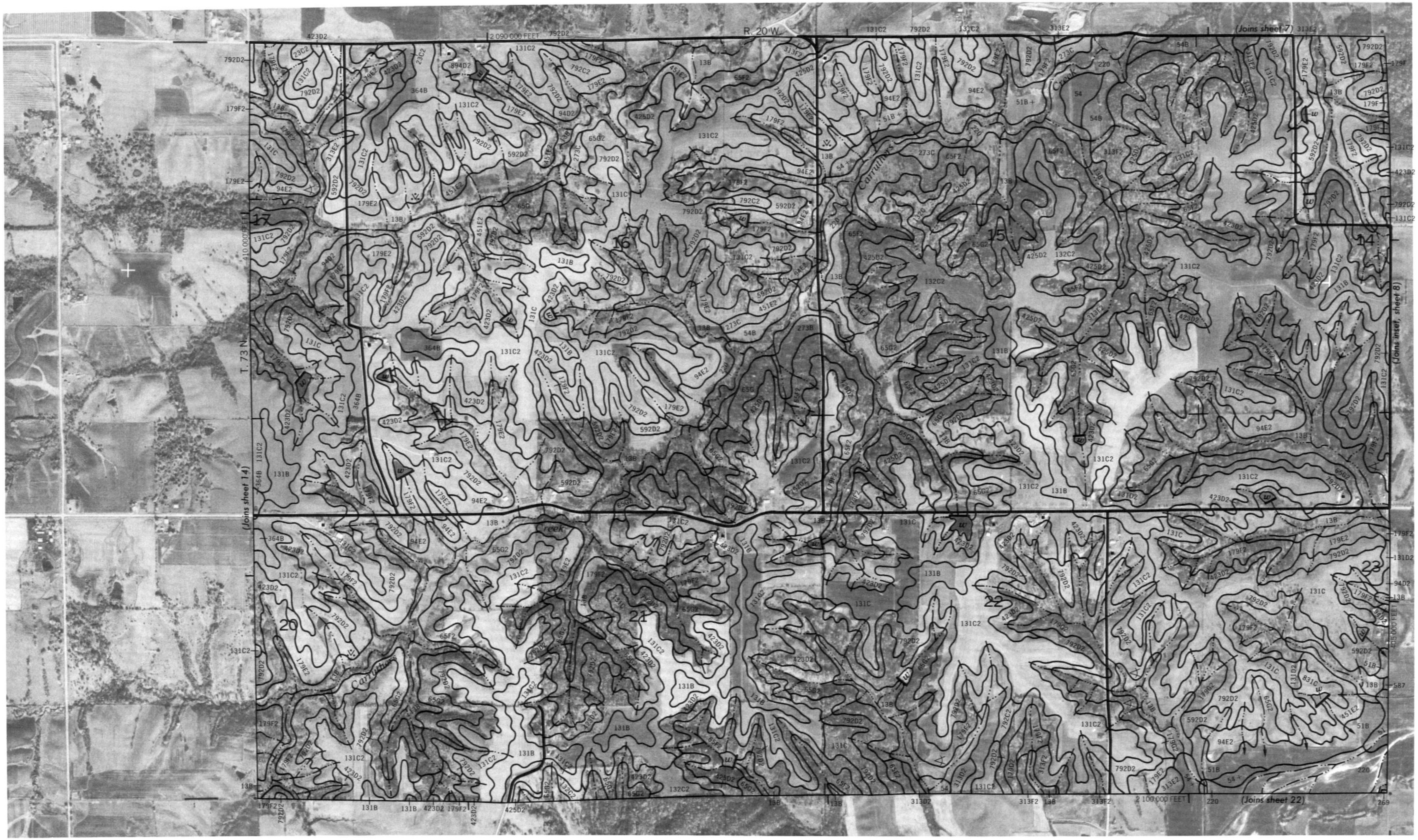
1 KILOMETER

SCALE 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1

N



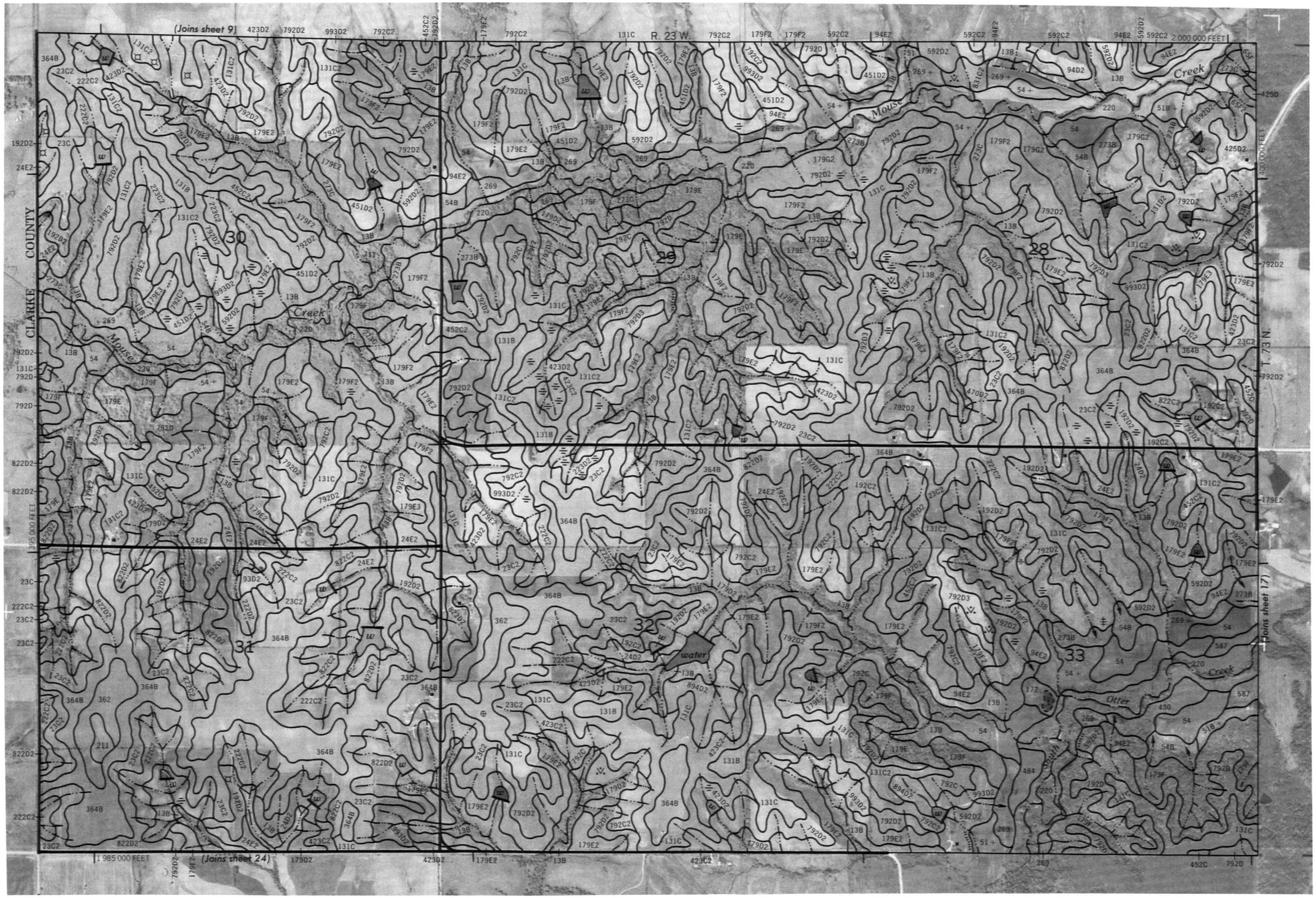
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1

N

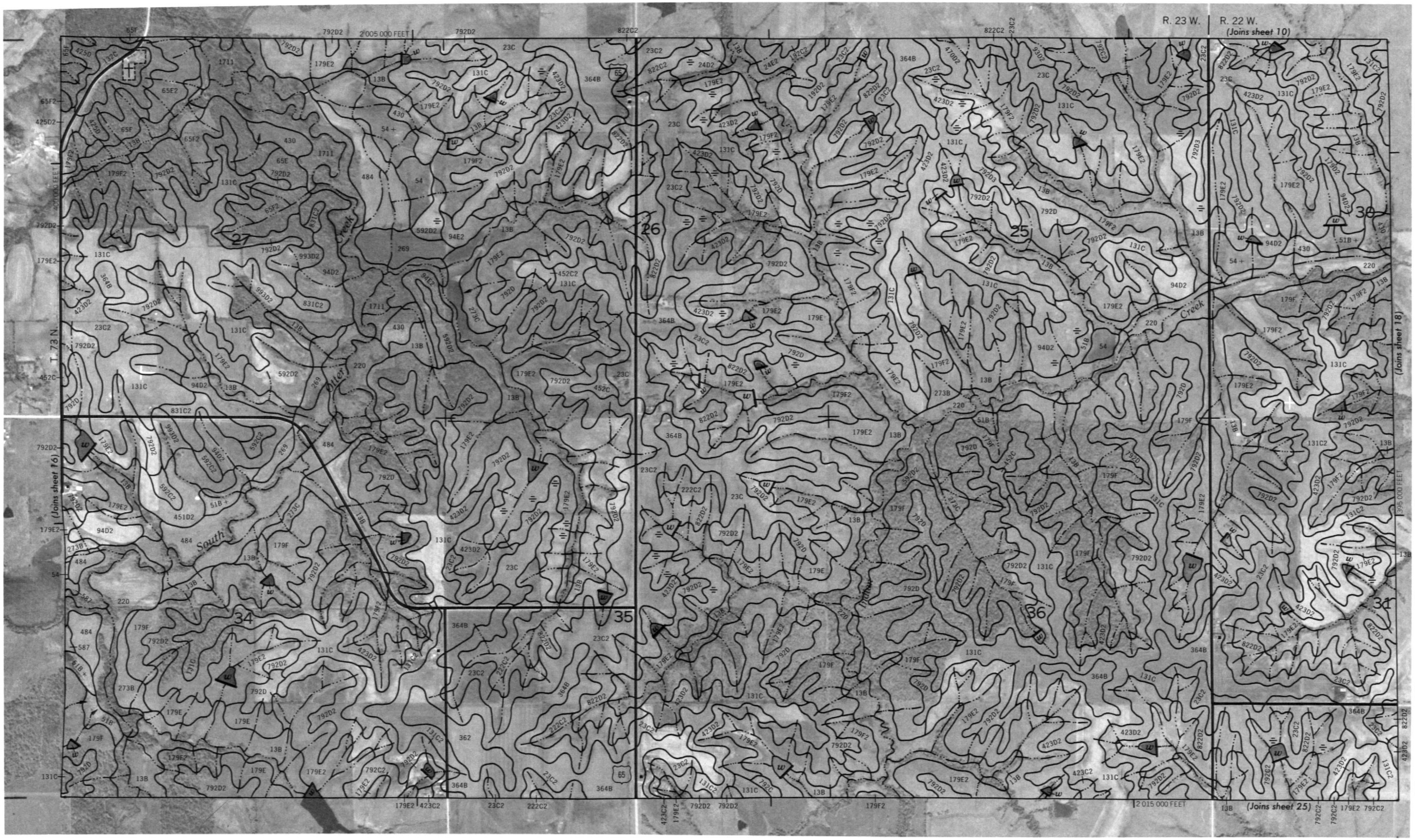
1 MILE

1 KILOMETER

SCALE 1:15 840



N

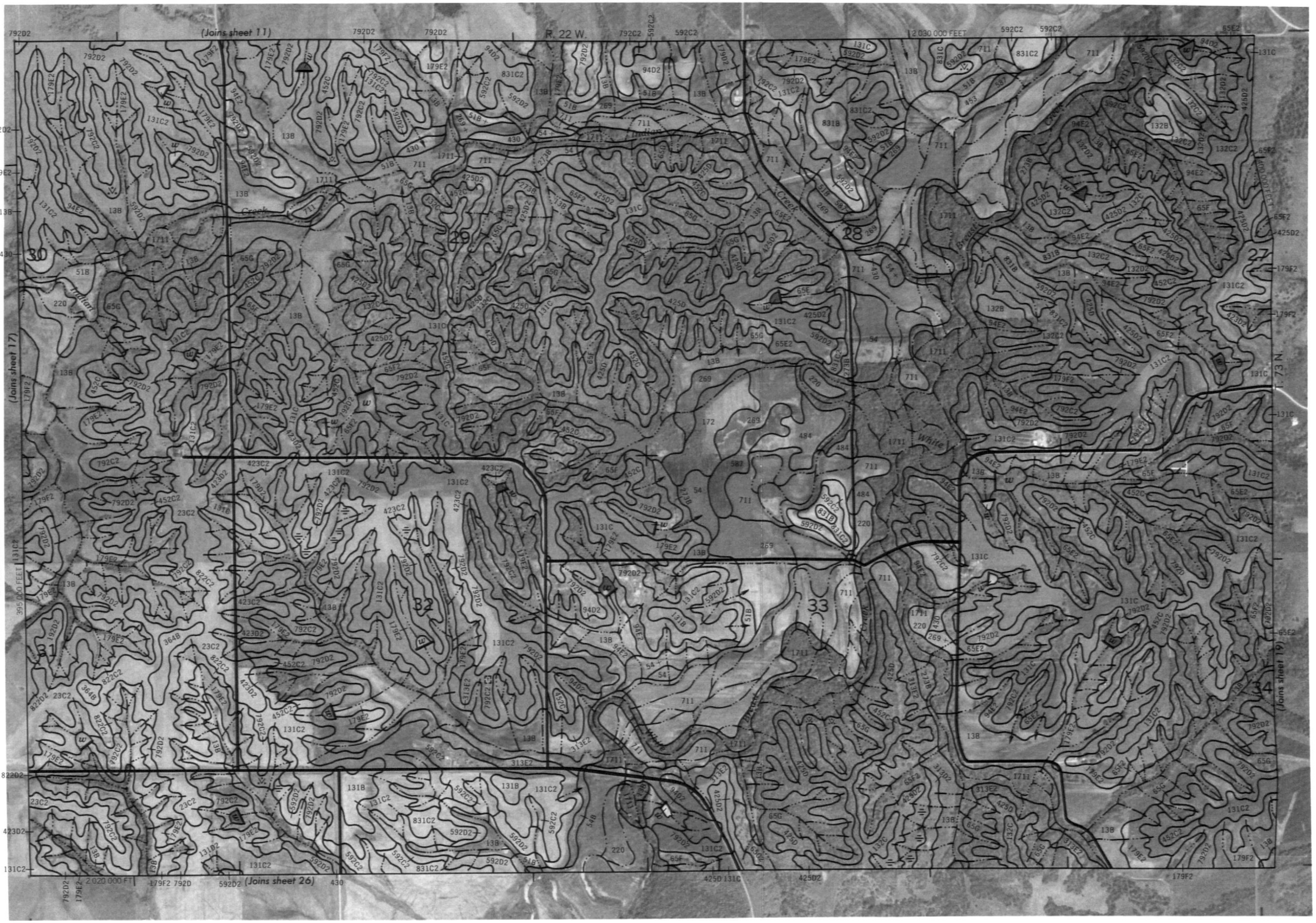


LUCAS COUNTY, IOWA NO. 17

1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1

18

N



1 MILE

1 KILOMETER

SCALE 1:15 840

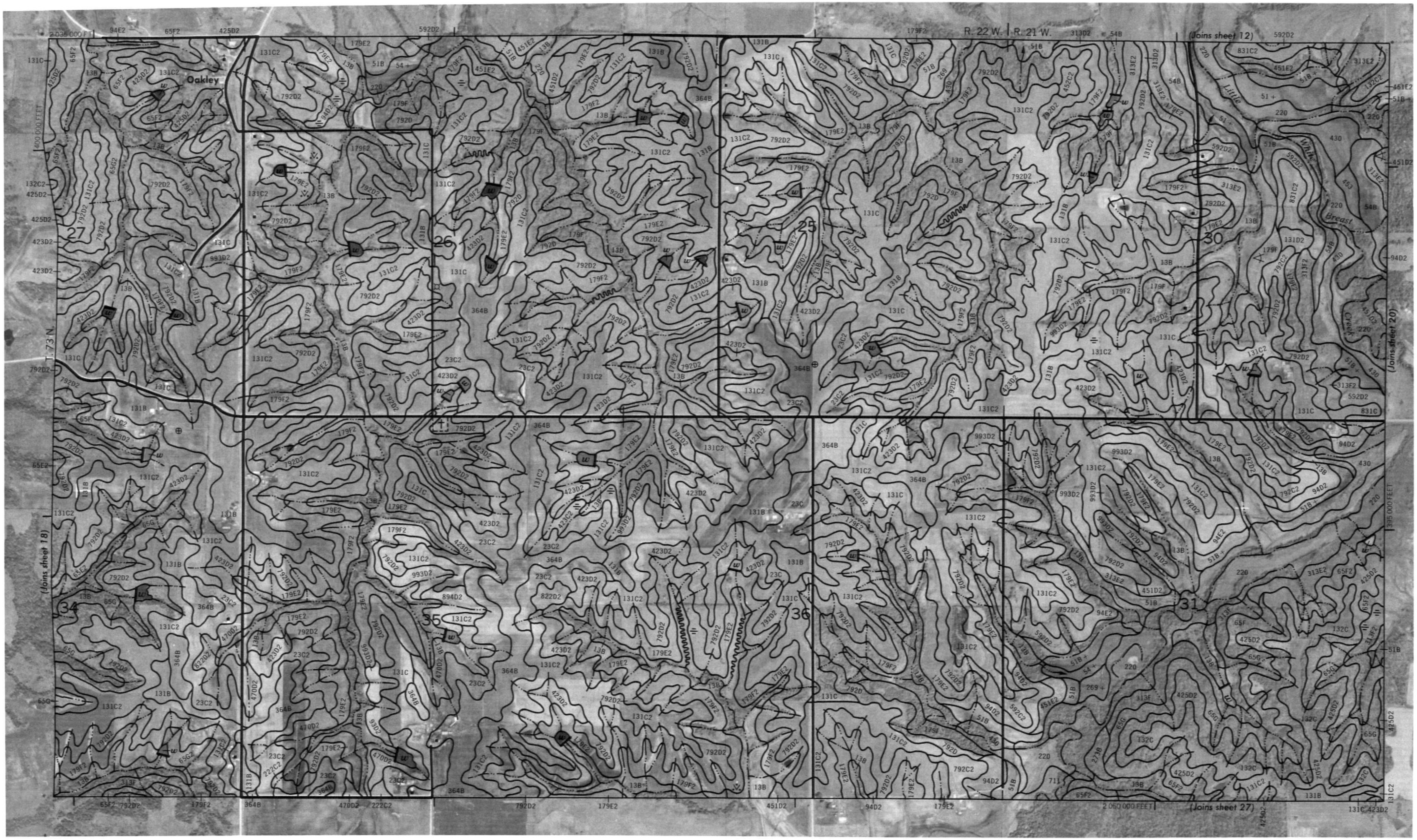
0 1/4 1/2 3/4 1

0 0.5 1

19

N

LUCAS COUNTY, IOWA NO. 19



1 MILE

1 KILOMETER

SCALE 1:15 840

0

1/4

0.5

1/2

3/4

1

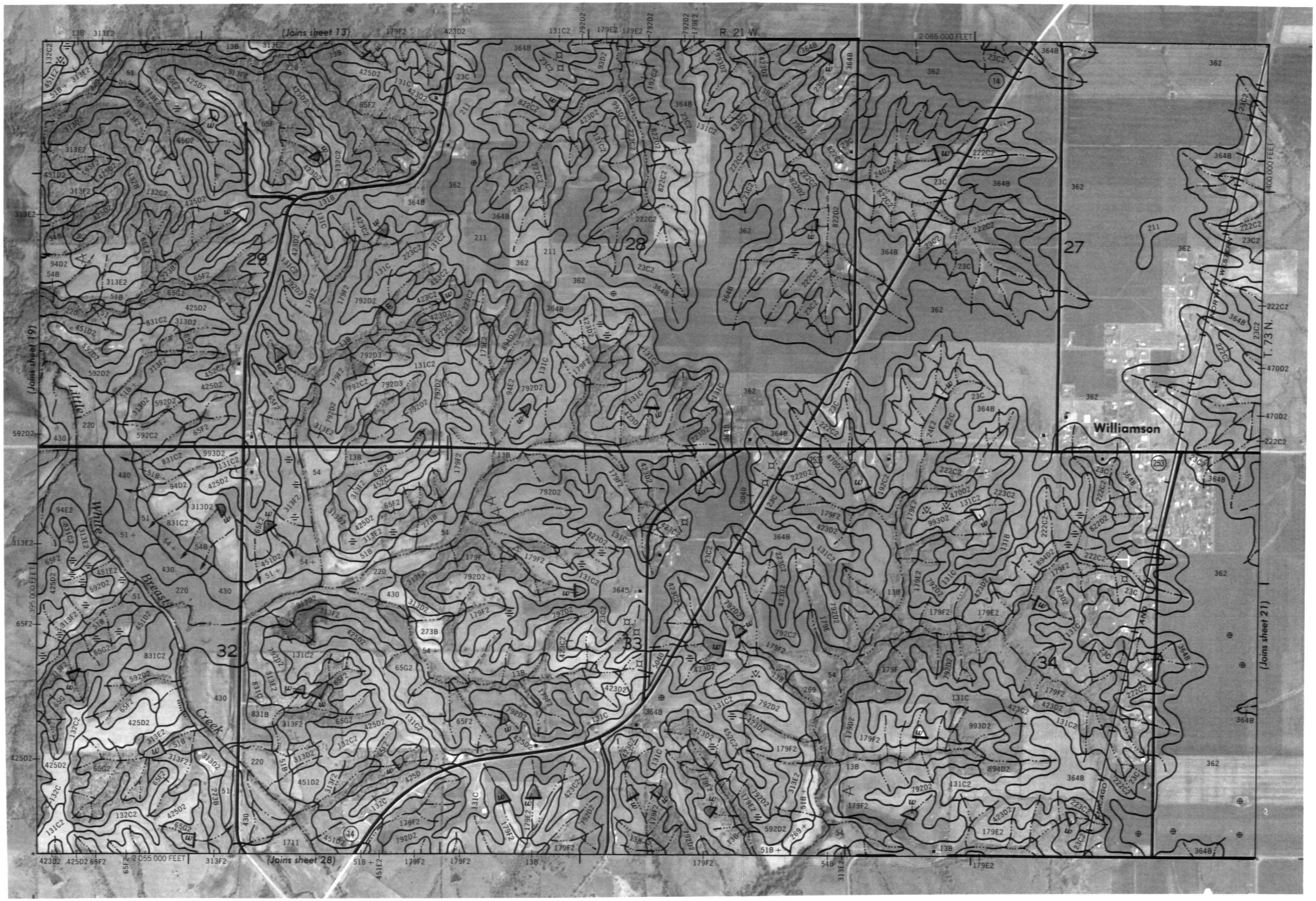
N

1 MILE

1 KILOMETER

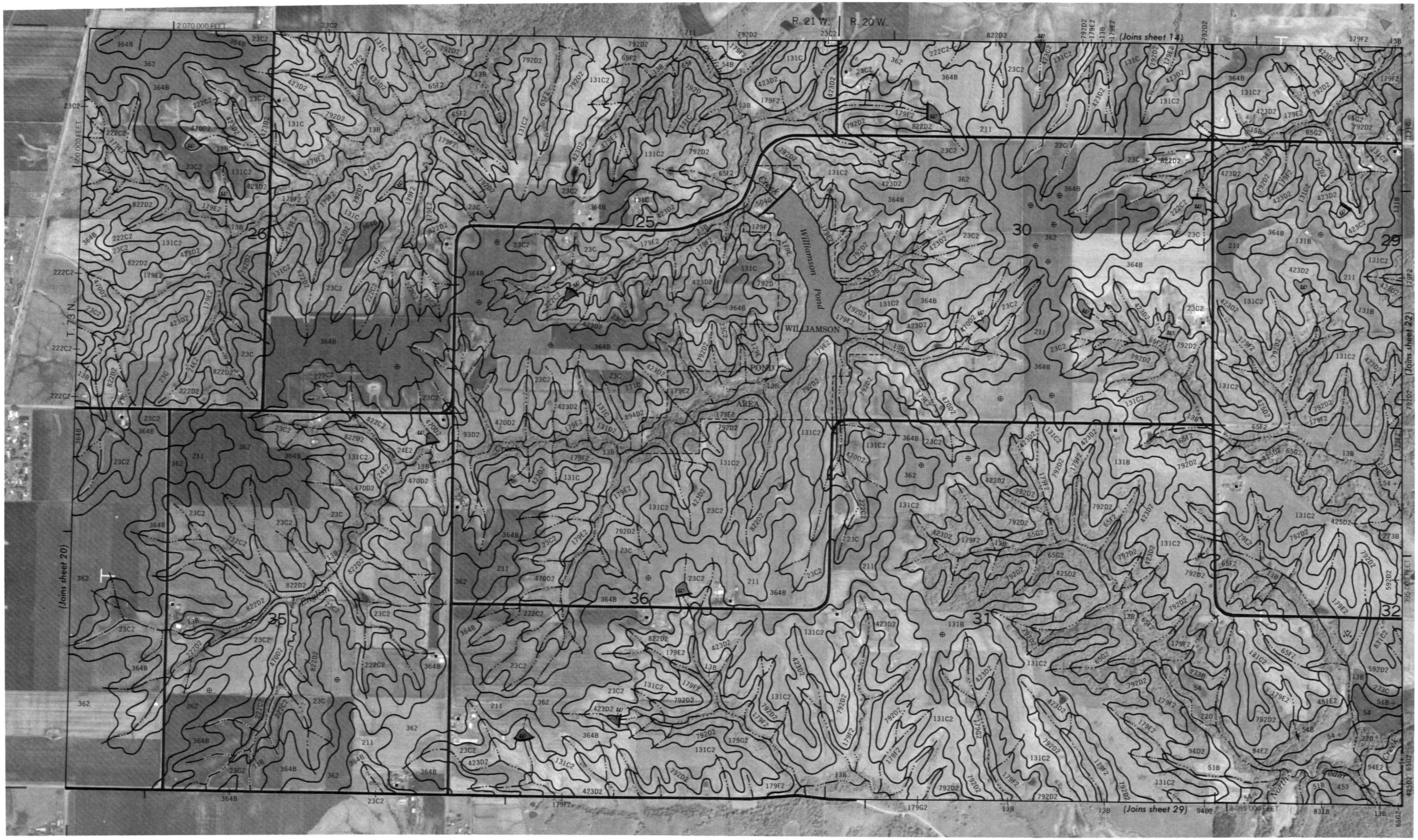
SCALE 1:15 840

0 0 1/4 0.5 1/2 1 3/4 1



21

N



1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1

LUCAS COUNTY, IOWA NO. 21

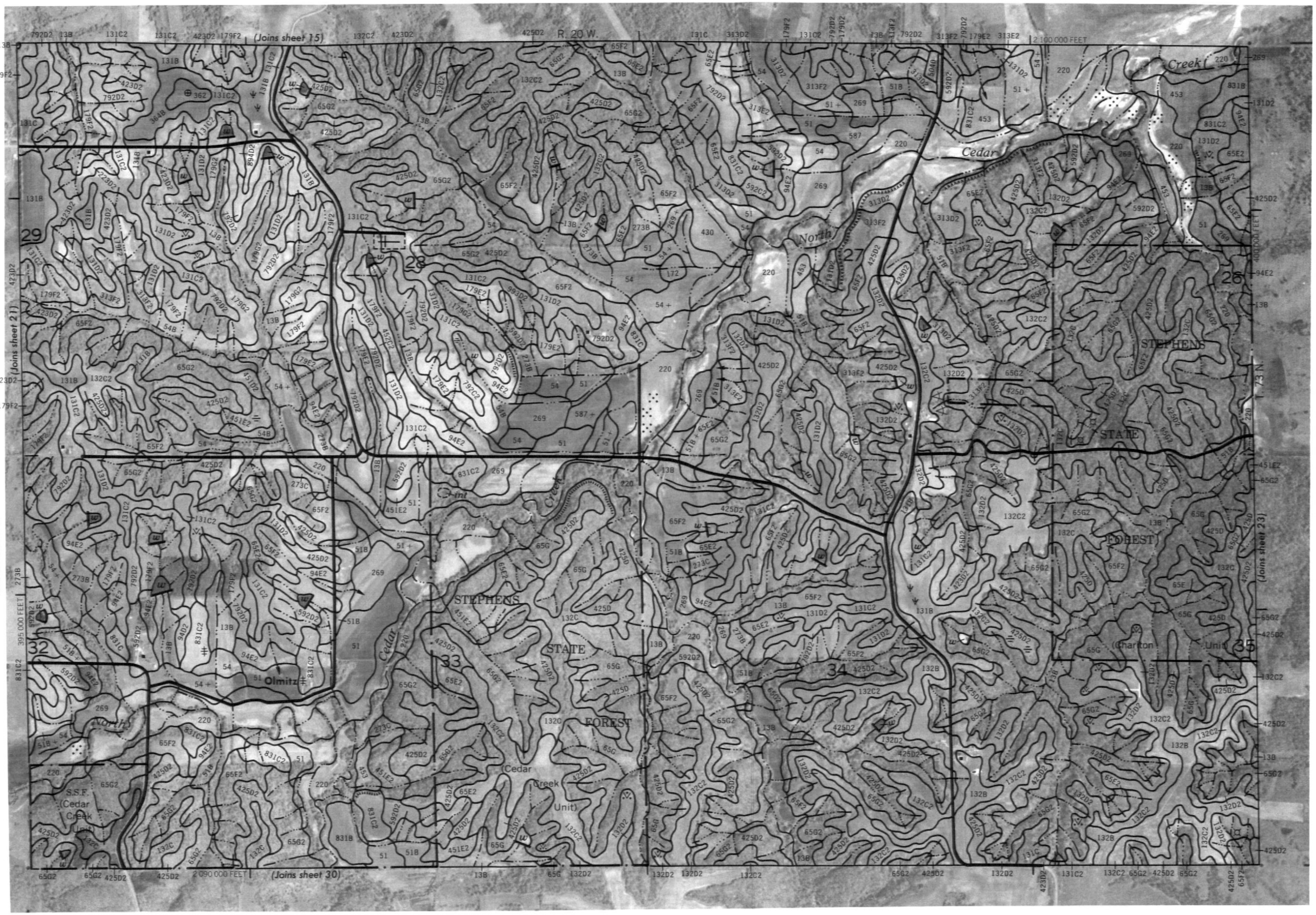
N

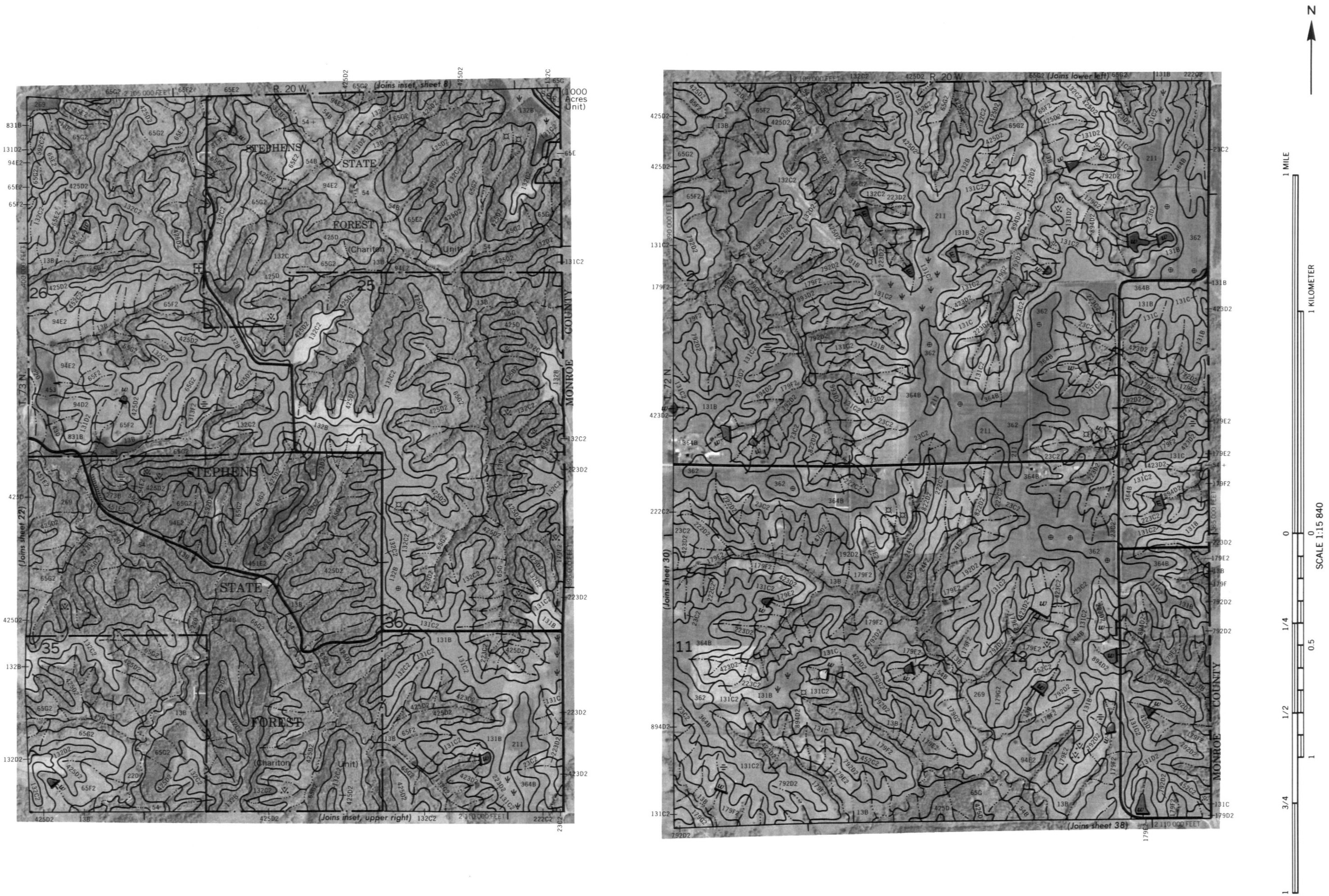
1 MILE

1 KILOMETER

SCALE 1:15 840

0 0 1/4 0.5 1/2 1 3/4 1




23
N
R. 20 W.
(Joins inset, sheet 8)
(1000 Acres Unit)
STEPHENS
STATE
FOREST
(Chariton
Unit)
T. 73 N.
(Joins sheet 22)
MONROE
COUNTY
(Joins inset, upper right)
R. 20 W.
(Joins lower left)
T. 72 N.
(Joins sheet 30)
(Joins sheet 38)
1 MILE
1 KILOMETER
SCALE 1:15 840

N

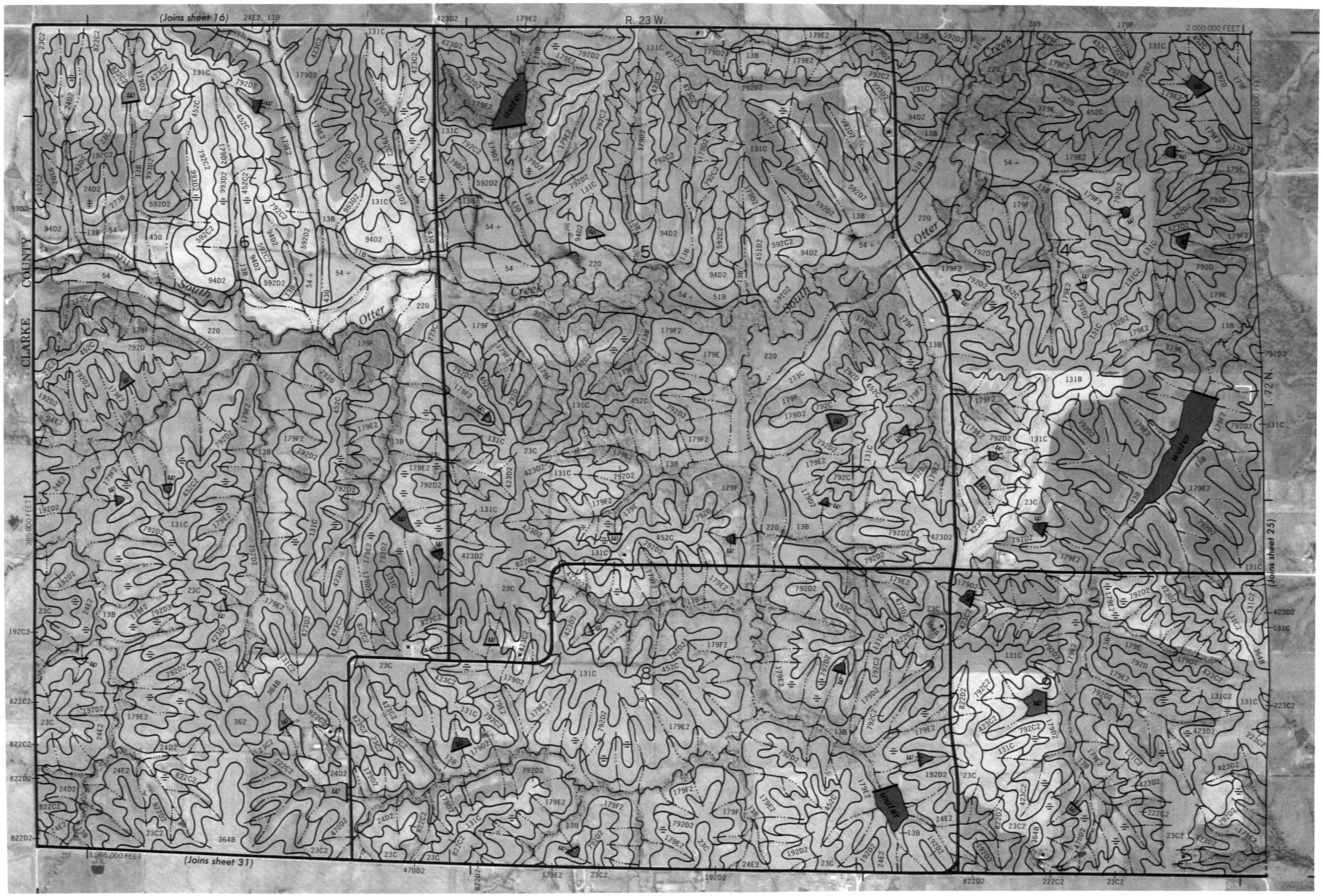
1 MILE

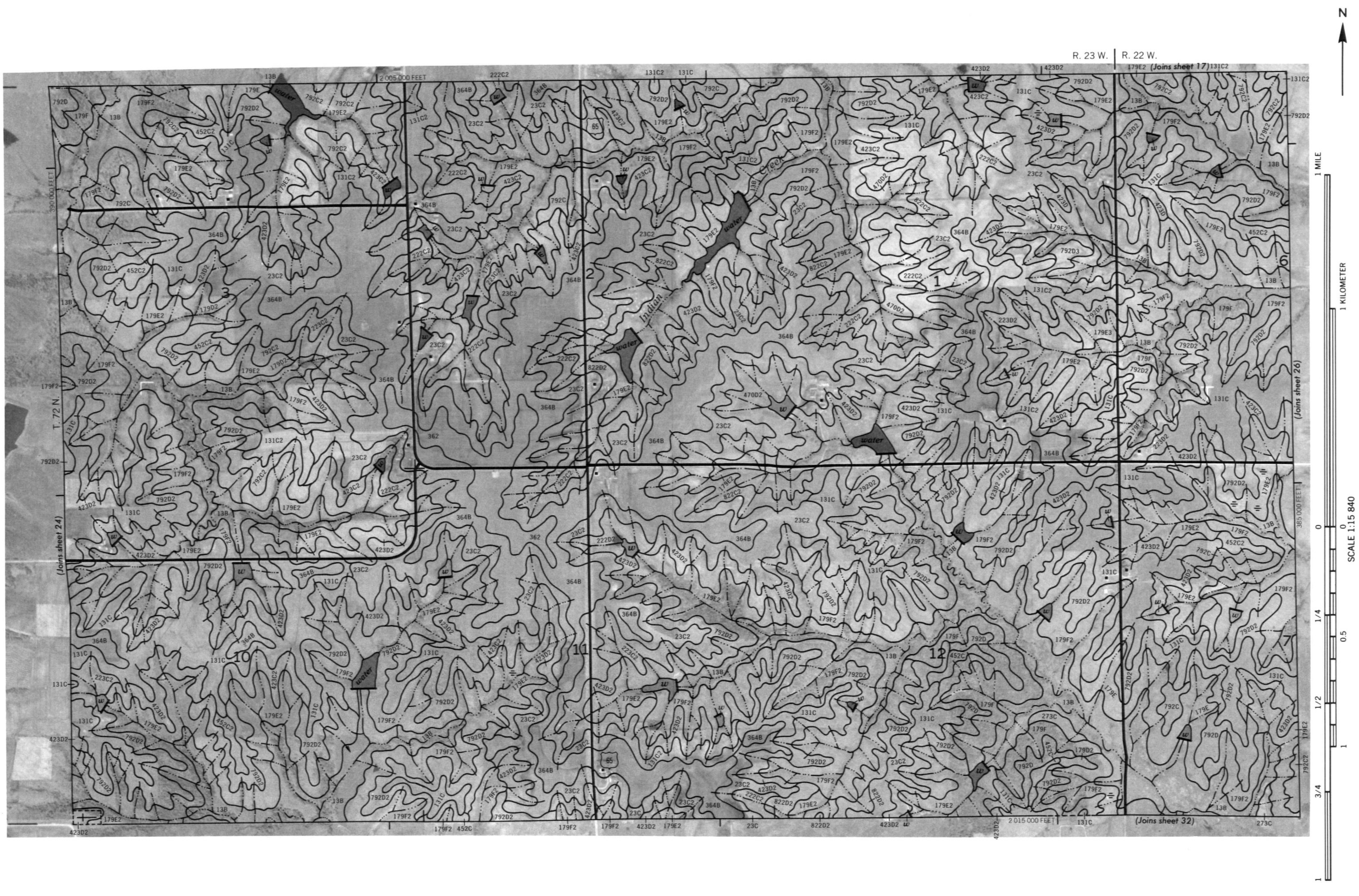
1 KILOMETER

SCALE 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1




N
R. 23 W.
R. 22 W.
(Joins sheet 17)
(Joins sheet 26)
(Joins sheet 32)
(Joins sheet 24)
T. 72 N.
2 005 000 FEET
2 015 000 FEET
390 000 FEET
385 000 FEET
Indian Creek
water
65
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0.5

N

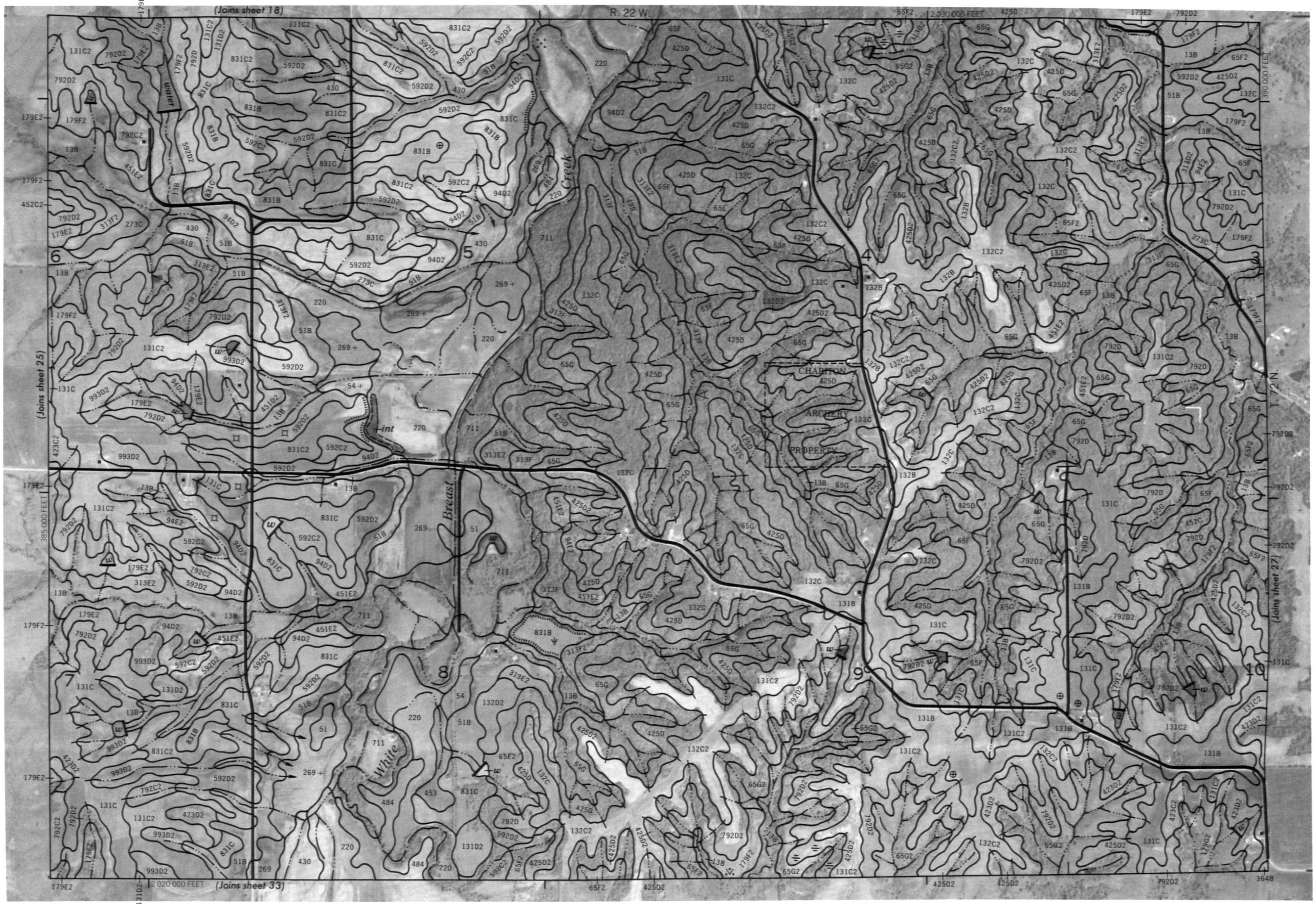
1 MILE

1 KILOMETER

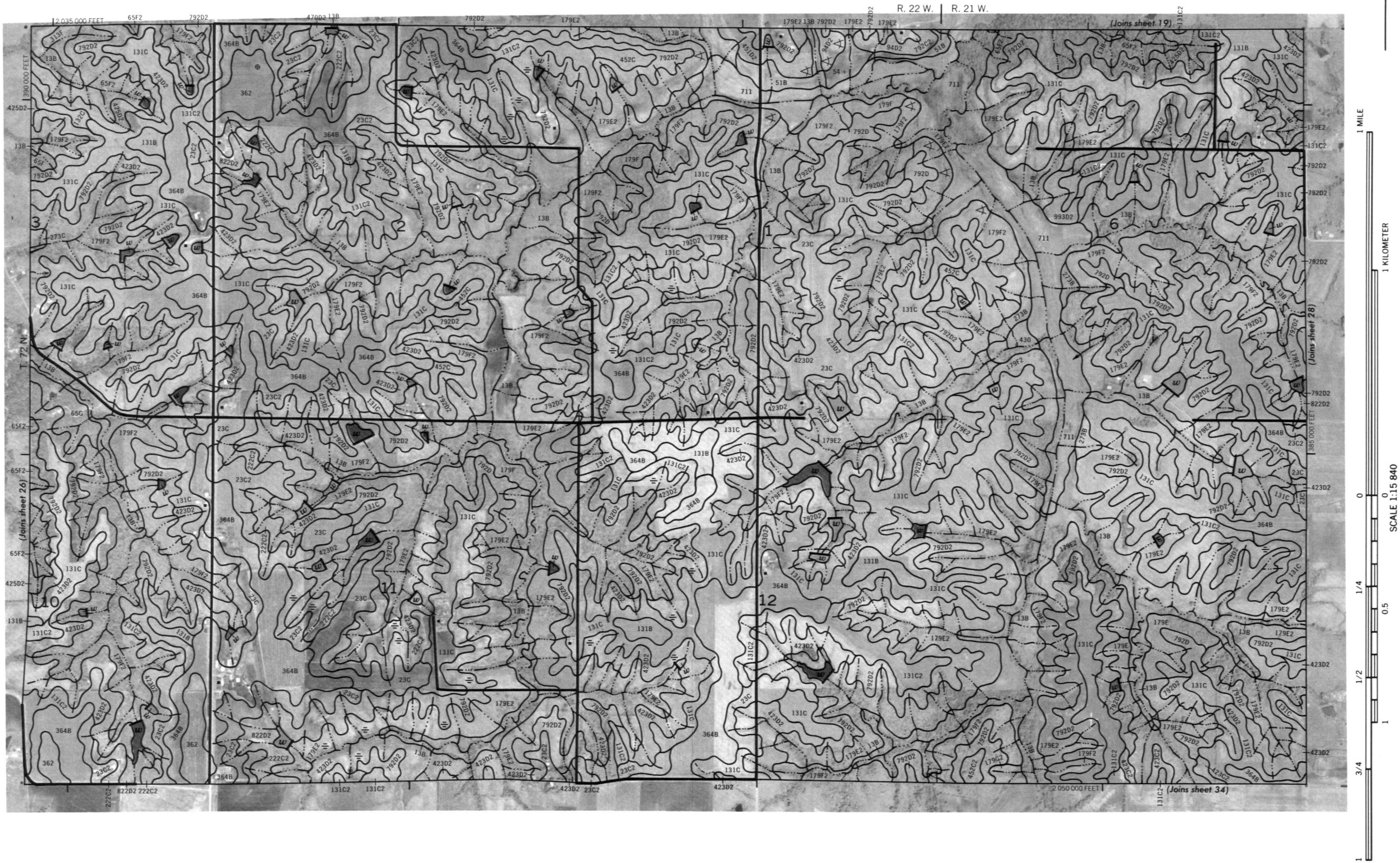
SCALE 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1



LUCAS COUNTY, IOWA NO. 27



N

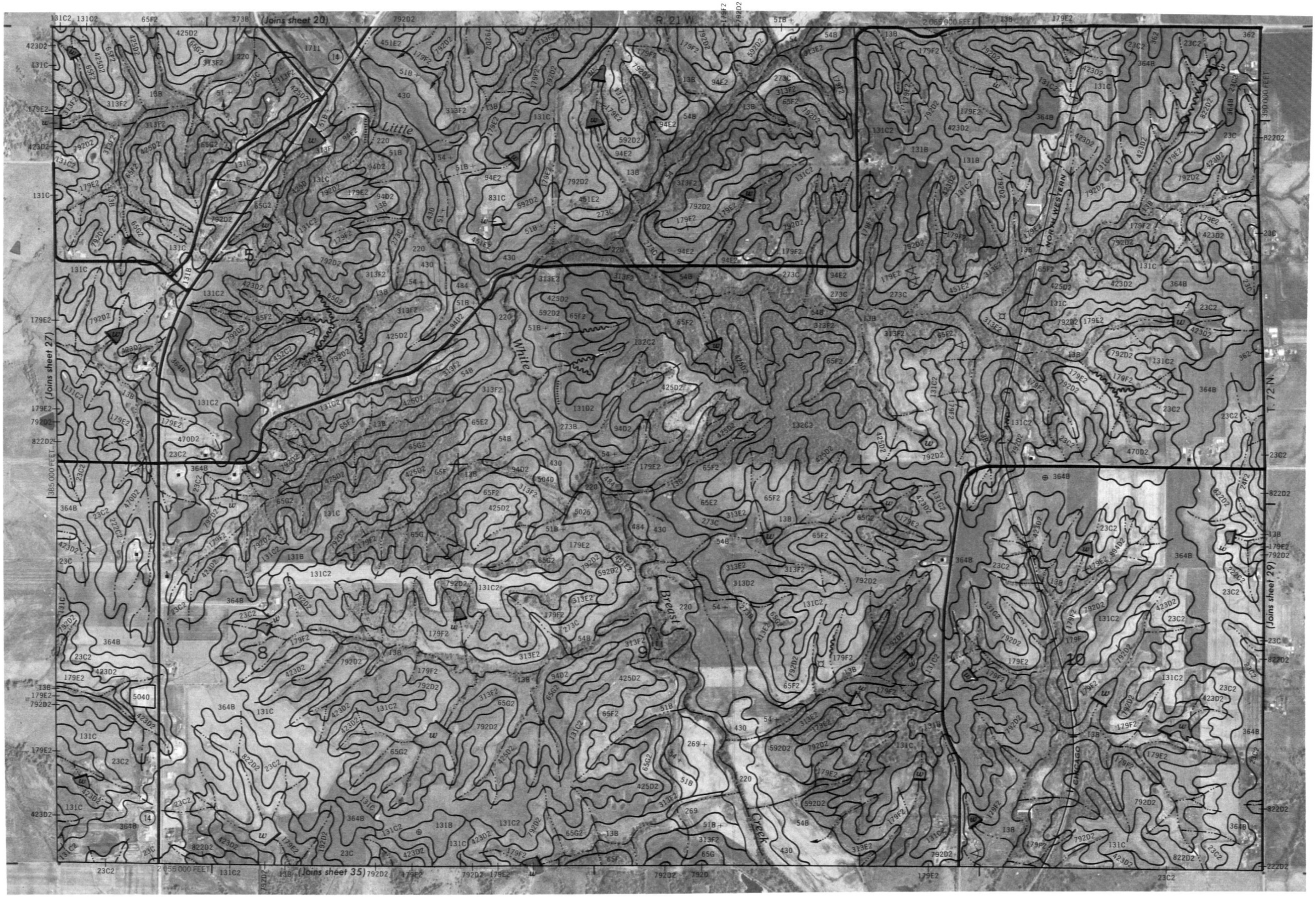
1 MILE

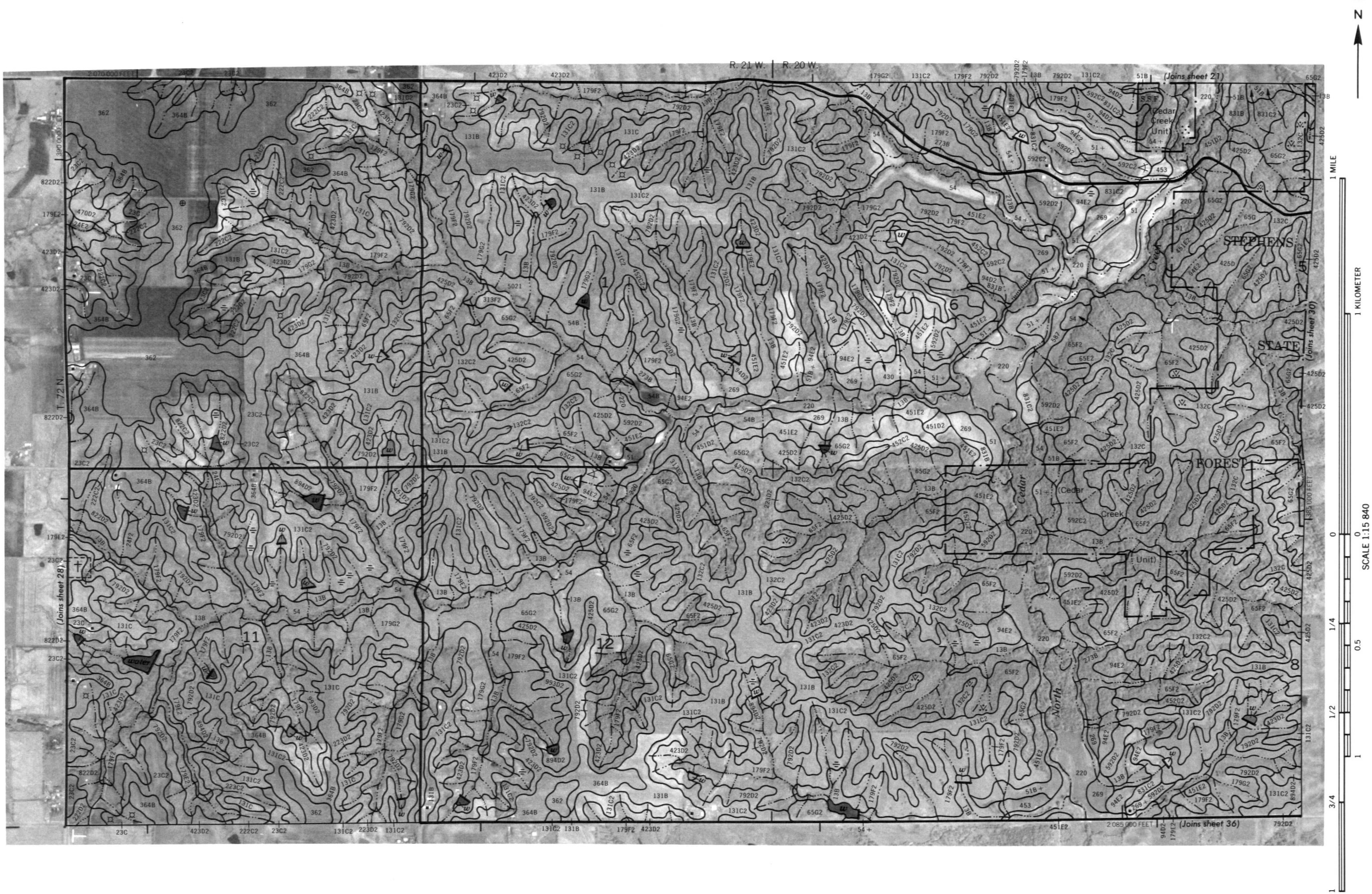
1 KILOMETER

SCALE 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1





LUCAS COUNTY, IOWA NO. 29

N

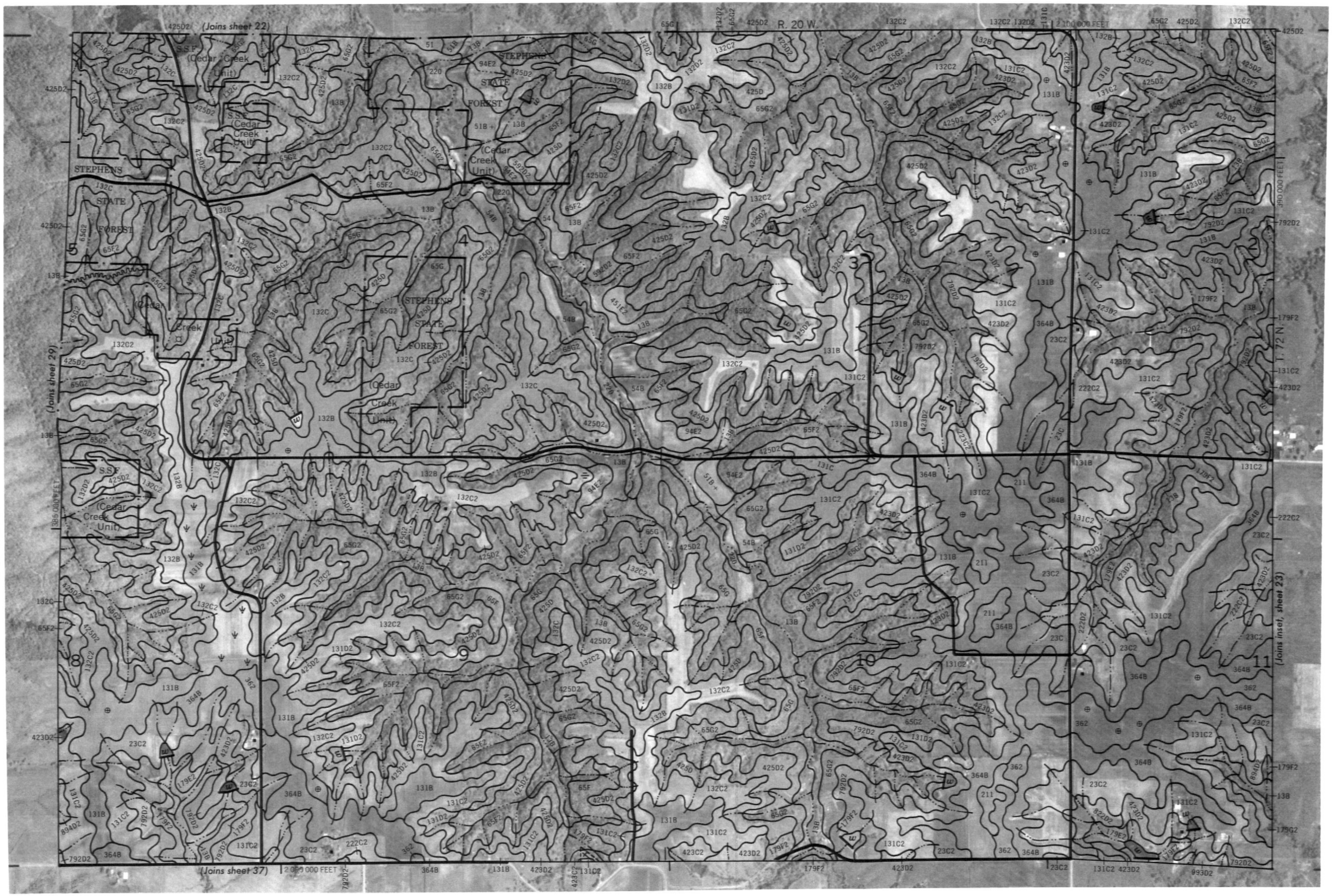
1 MILE

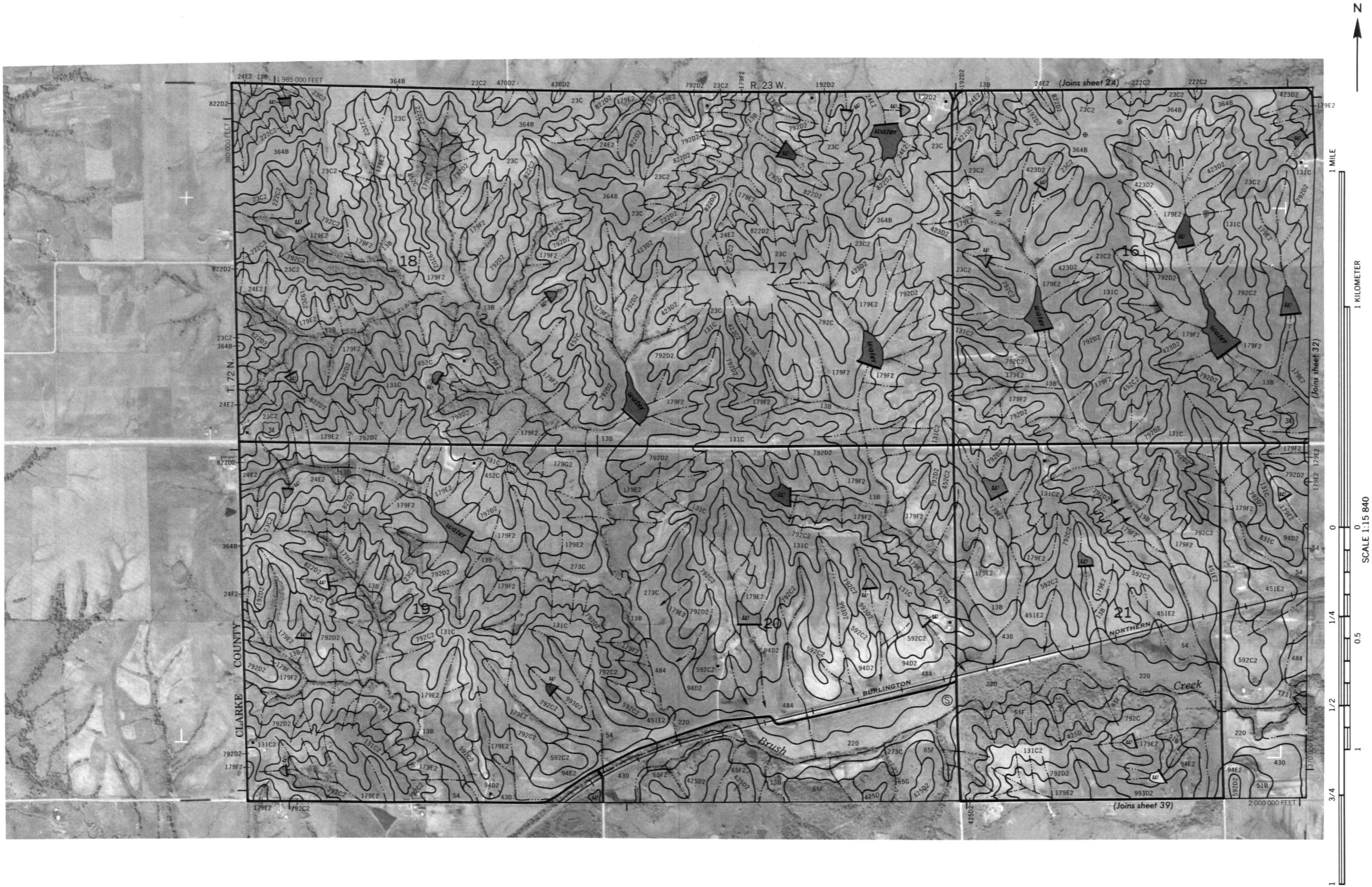
1 KILOMETER

SCALE 1:15 840

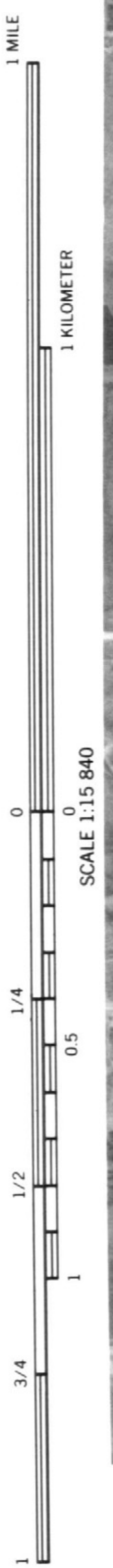
0 1/4 1/2 3/4 1

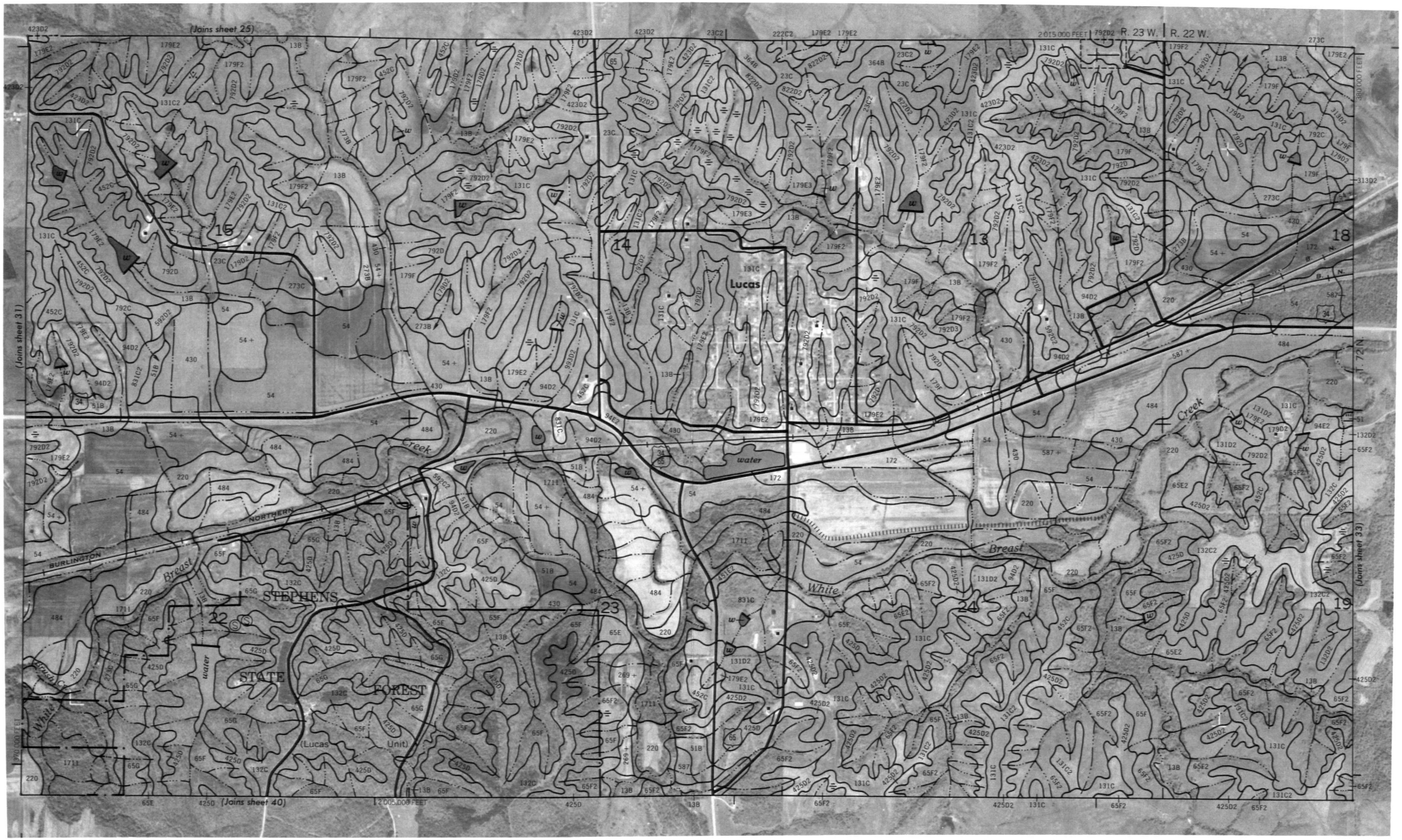
0 0.5 1

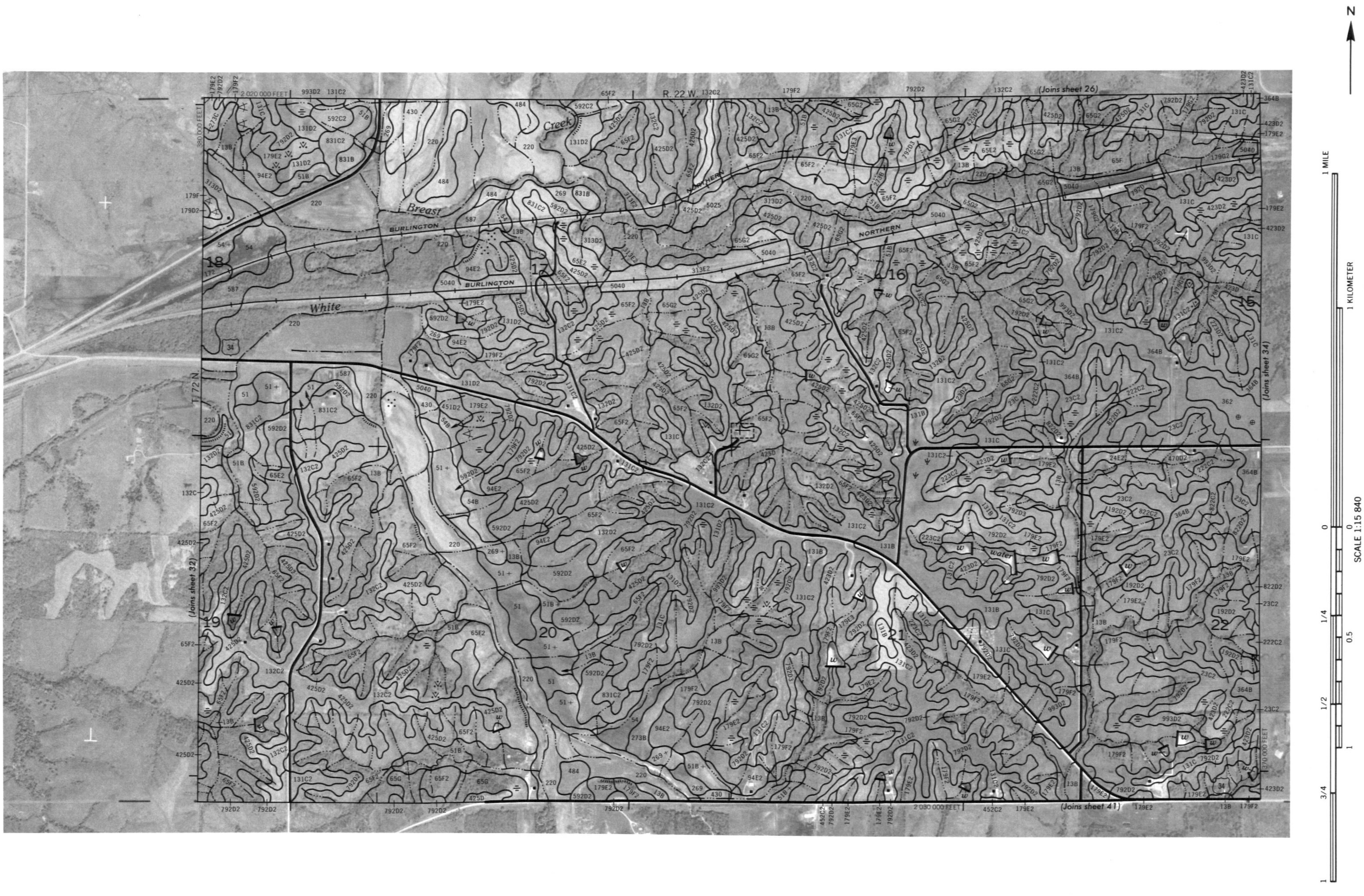


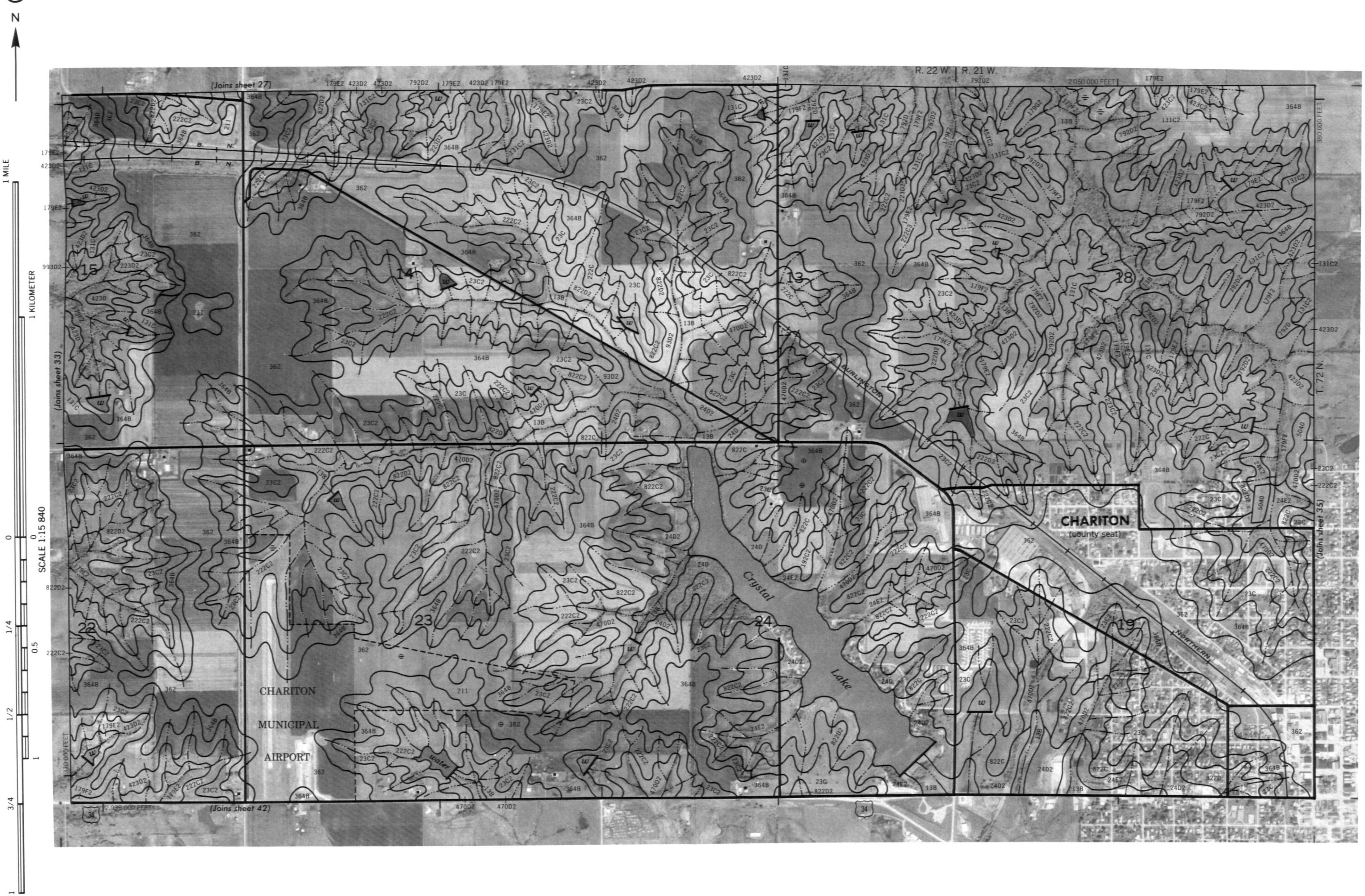

31
N
R. 23 W.
T. 72 N.
(Joins sheet 24)
(Joins sheet 32)
(Joins sheet 39)
1 985 000 FEET
380 000 FEET
370 000 FEET
2 000 000 FEET
CLARKE COUNTY
BURLINGTON
NORTHERN
Brush
Creek
16
17
18
19
20
21
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0.5

N

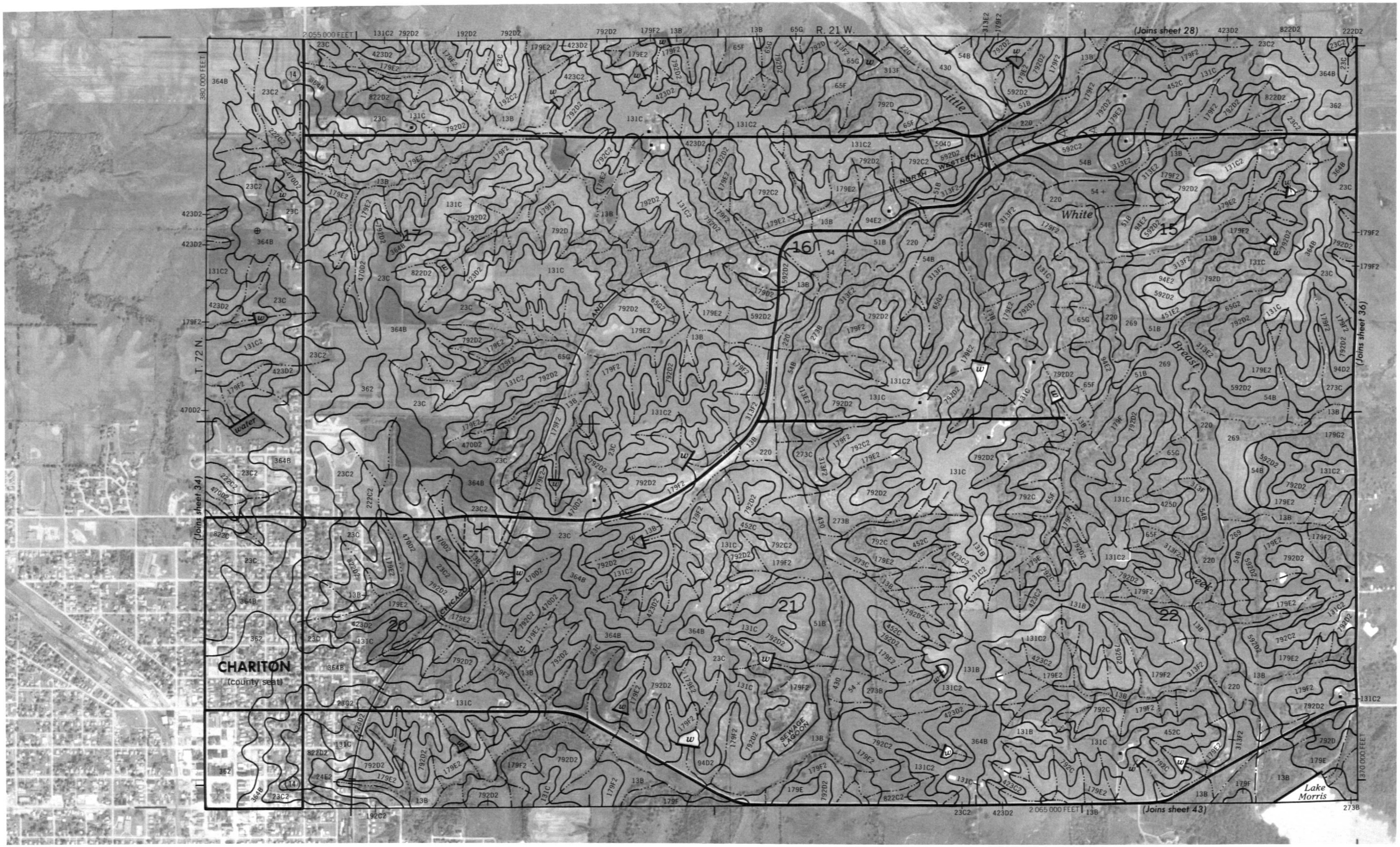

1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1


(Joins sheet 25)
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 40)
R. 23 W.
R. 22 W.
T. 72 N.
2 015 000 FEET
2 005 000 FEET
Lucas
water
STEPHENS
STATE
FOREST
(Lucas
Unit)
BURLINGTON
NORTHERN
Breast
Creek
White
15
14
13
18
22
23
24
19

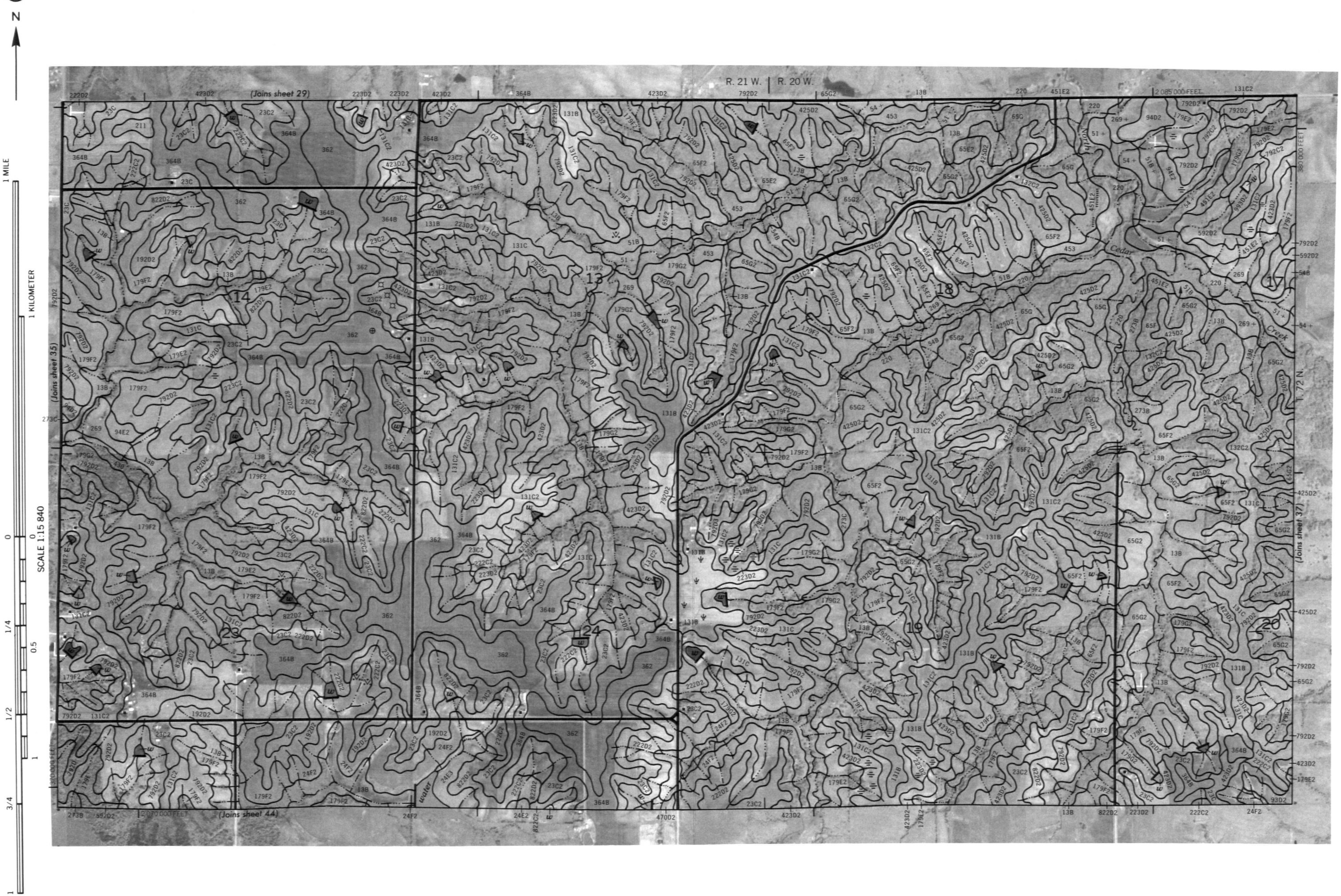

N
(Joins sheet 26)
(Joins sheet 34)
(Joins sheet 41)
(Joins sheet 32)
R. 22 W.
T. 72 N.
2 020 000 FEET
2 030 000 FEET
380 000 FEET
370 000 FEET
Breast
Creek
White
BURLINGTON
NORTHERN
34
16
17
18
19
20
21
22
15
water
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0.5


N
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 27)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 42)
R. 22 W.
R. 21 W.
T. 72 N.
2 050 000 FEET
380 000 FEET
2 035 000 FEET
370 000 FEET
15
14
13
18
22
23
24
19
BURLINGTON
NORTHERN
CHARITON
(county seat)
CHARITON
MUNICIPAL
AIRPORT
Crystal
Lake
water
34

N

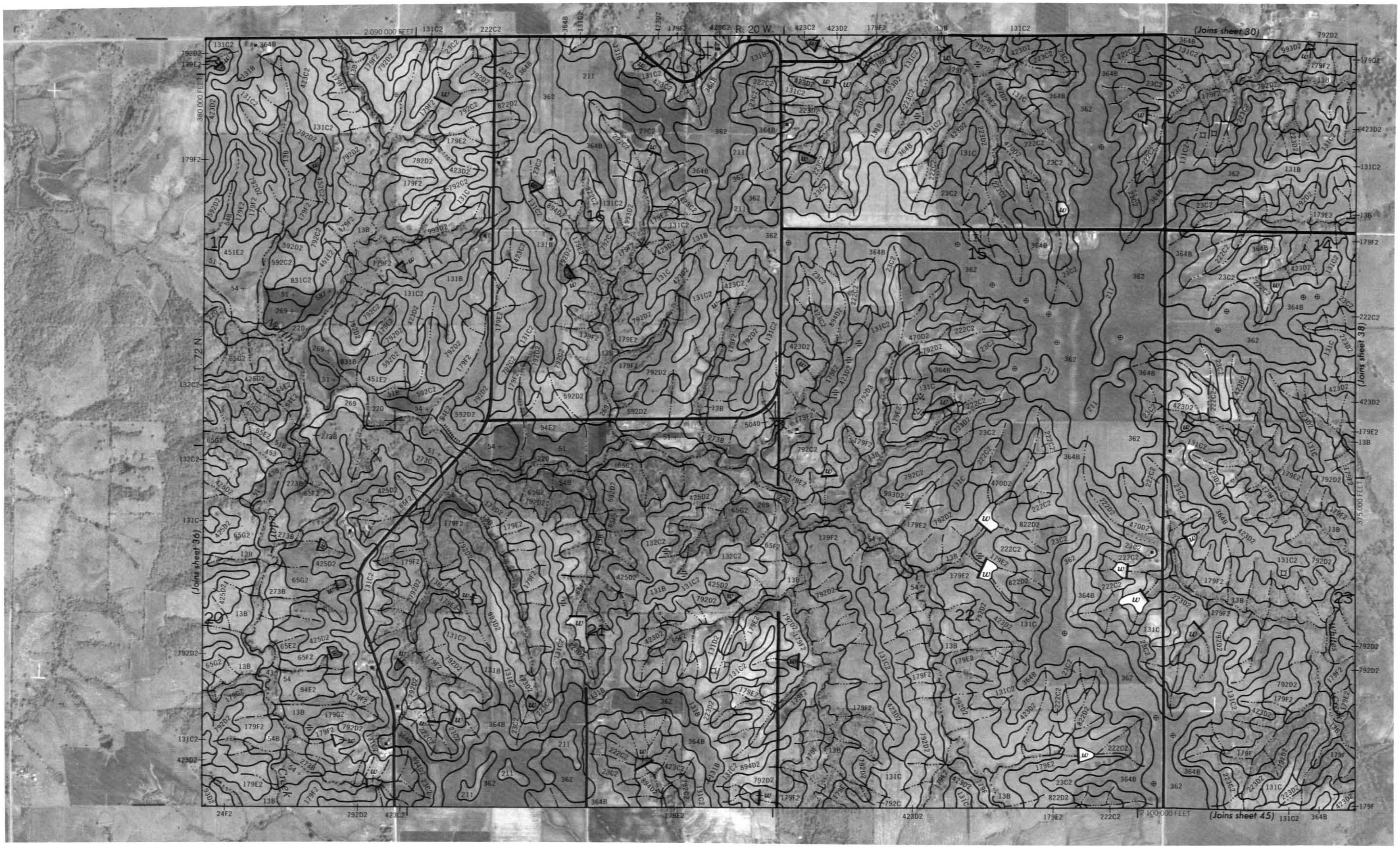


1 MILE
1 KILOMETER
SCALE 1:15 840
0 0
1/4
0.5
1/2
1
3/4
1


N
1 MILE
1 KILOMETER
SCALE 1:15 840
(Joins sheet 29)
(Joins sheet 35)
(Joins sheet 37)
(Joins sheet 44)
R. 21 W.
R. 20 W.
T. 72 N.
Cedar
Creek
13
14
17
18
19
20
23
24

N

LUCAS COUNTY, IOWA NO. 37



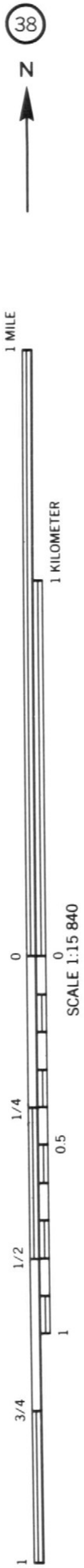
1 MILE

1 KILOMETER

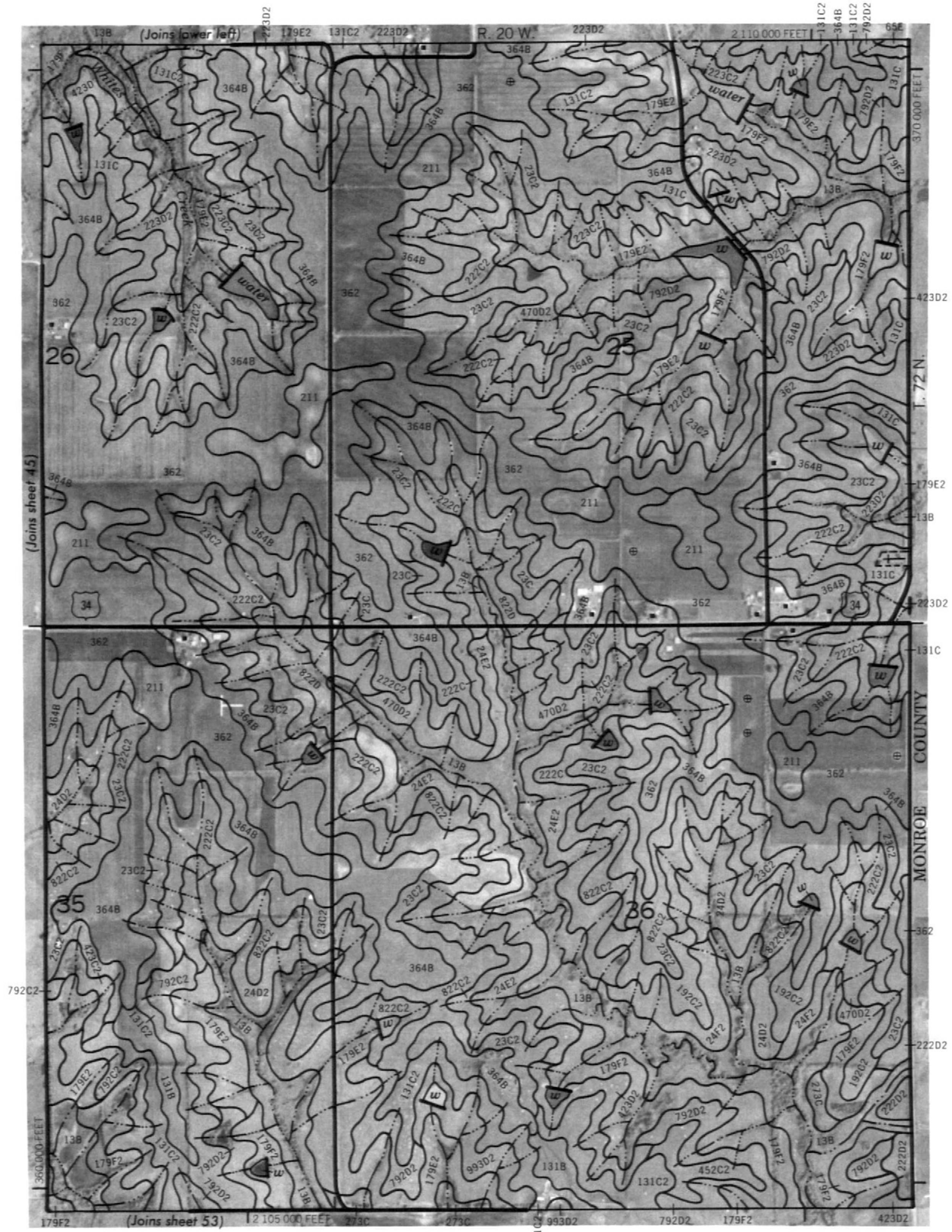
SCALE 1:15 840

0
1/4
1/2
3/4
1

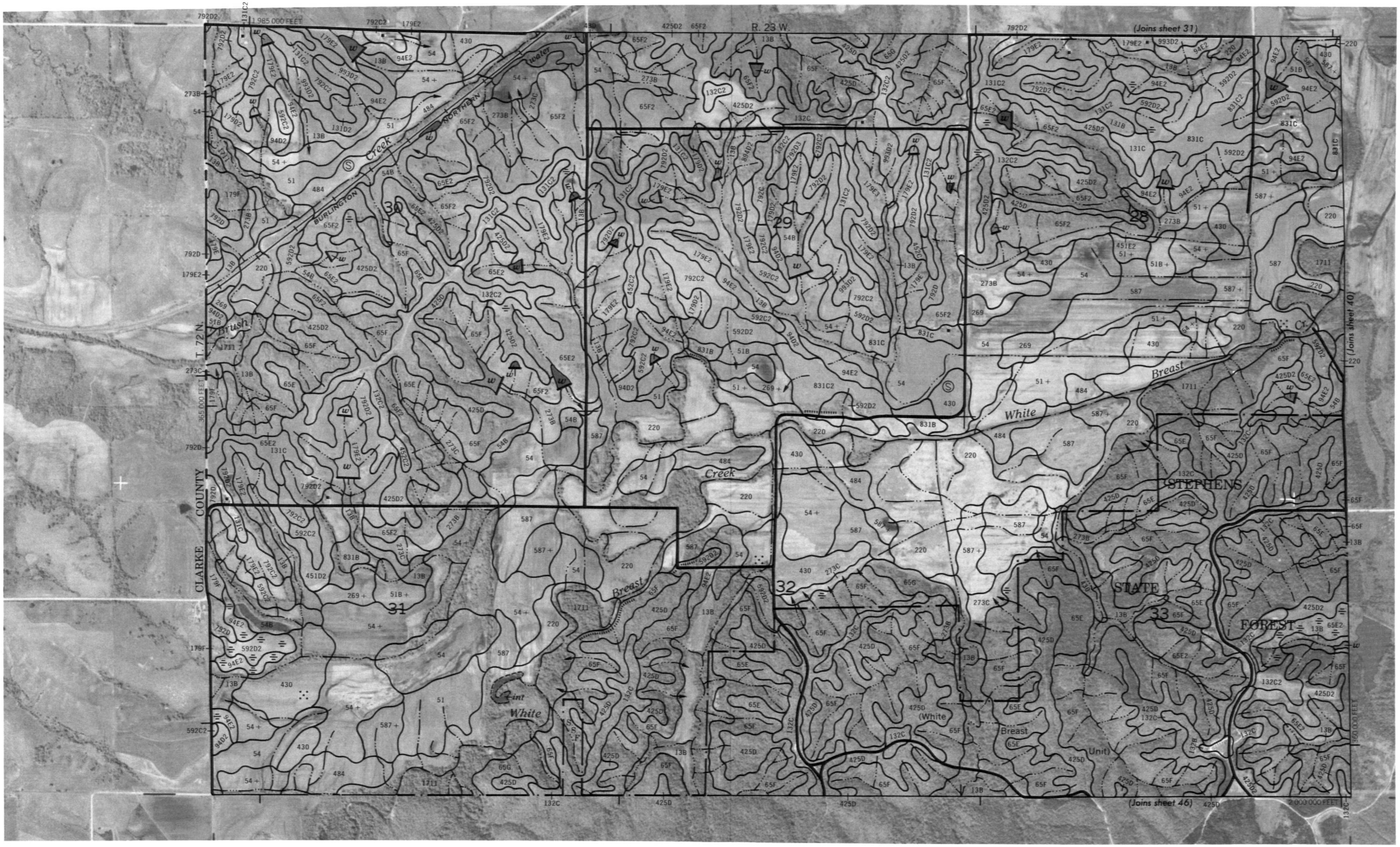
0
0.5
1

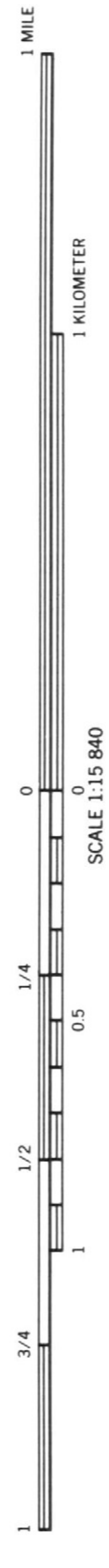

38
N
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1


(Joins inset, sheet 23)
R. 20 W.
(Joins sheet 37)
(Joins inset, upper right)
T. 72 N.
MONROE COUNTY
White Creek
14
13
23
24

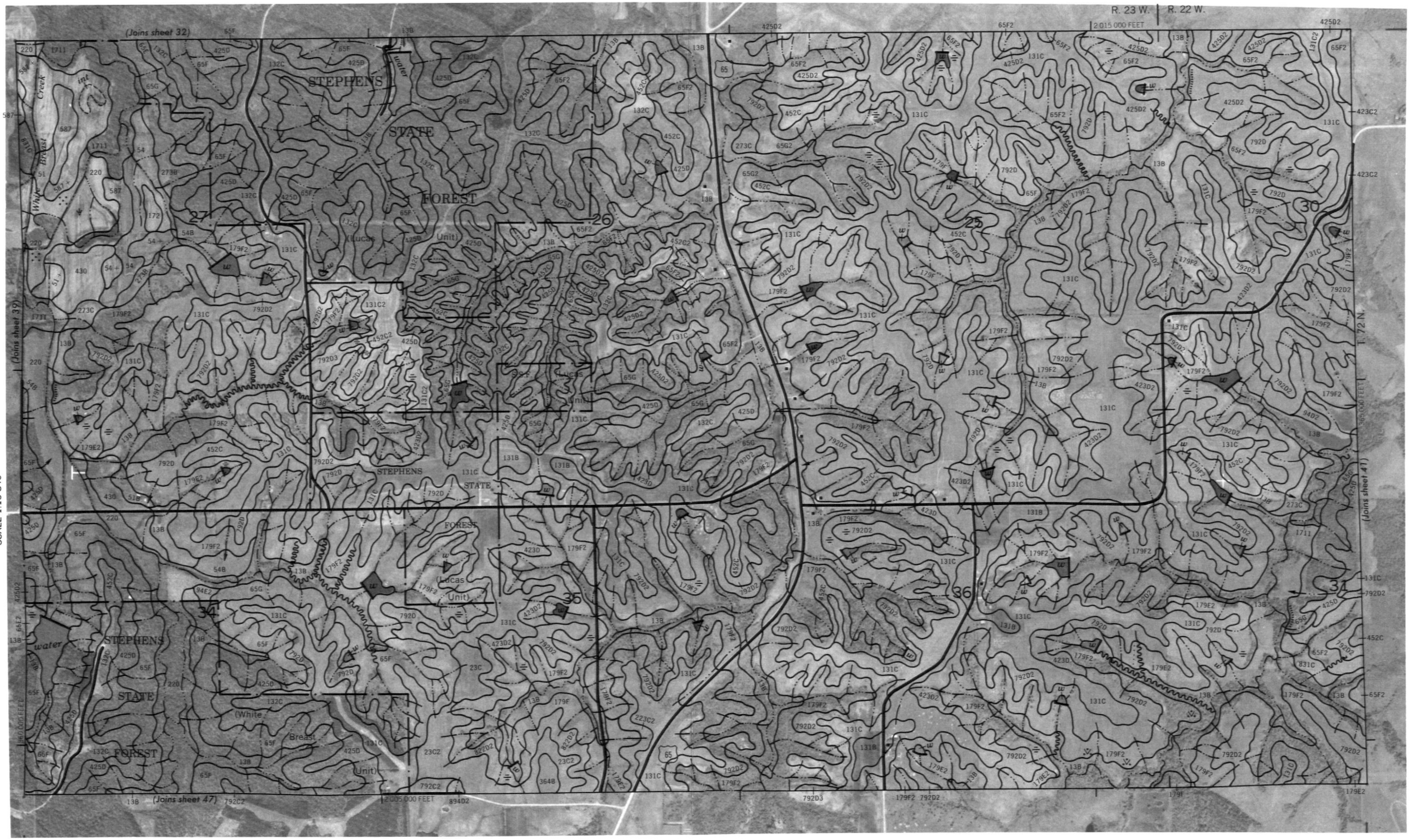

(Joins lower left)
R. 20 W.
(Joins sheet 45)
(Joins sheet 53)
T. 72 N.
MONROE COUNTY
26
25
35
36

N


(Joins sheet 31)
(Joins sheet 40)
(Joins sheet 46)
R. 23 W.
T. 72 N.
CLARKE COUNTY
1 985 000 FEET
365 000 FEET
2 000 000 FEET
360 000 FEET
BURLINGTON NORTHERN
Brush
Creek
White
Breast
Cr.
STEPHENS
STATE
FOREST
(White Breast Unit)
28
29
30
31
32
33

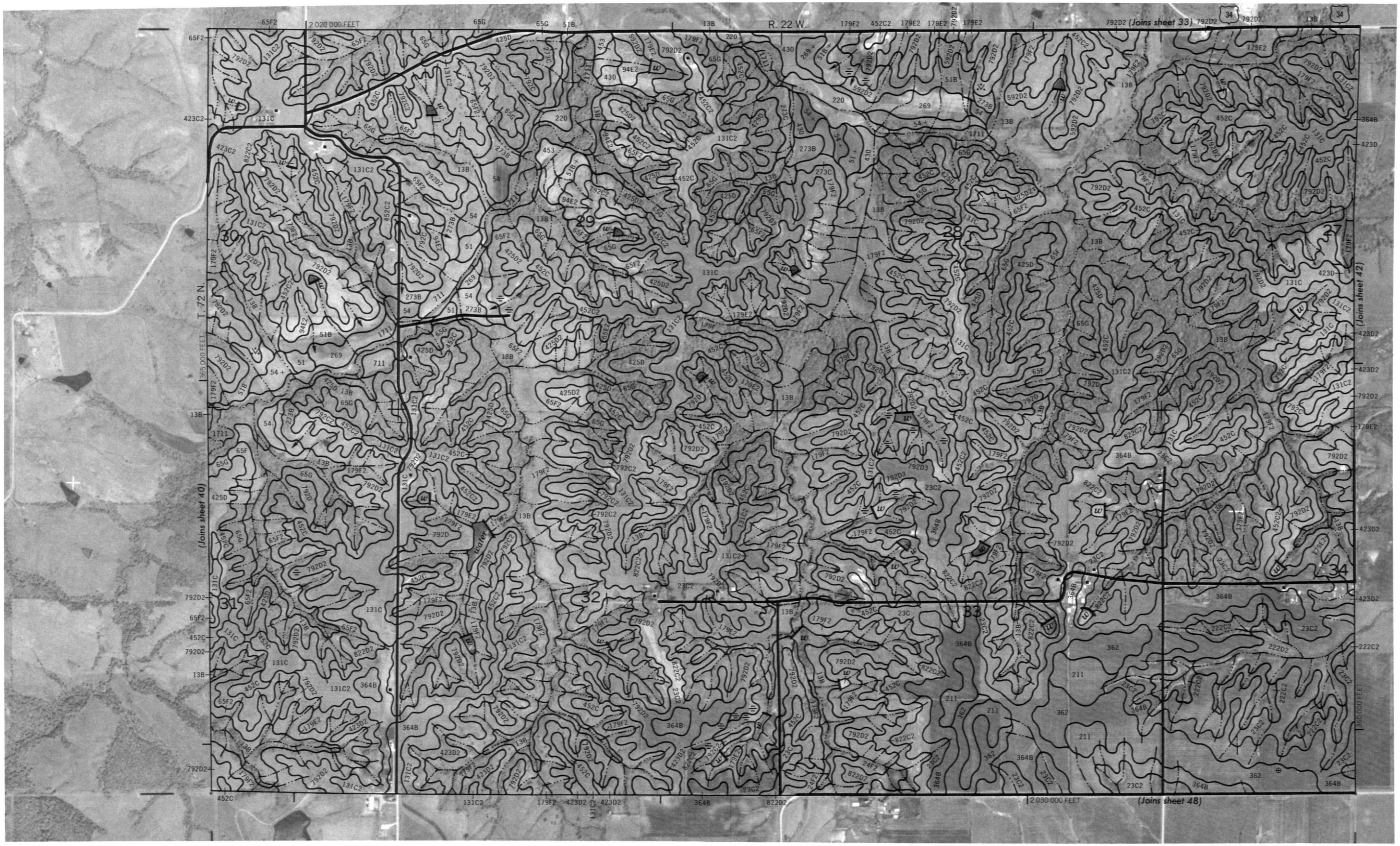

1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0.5

N



1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1

N



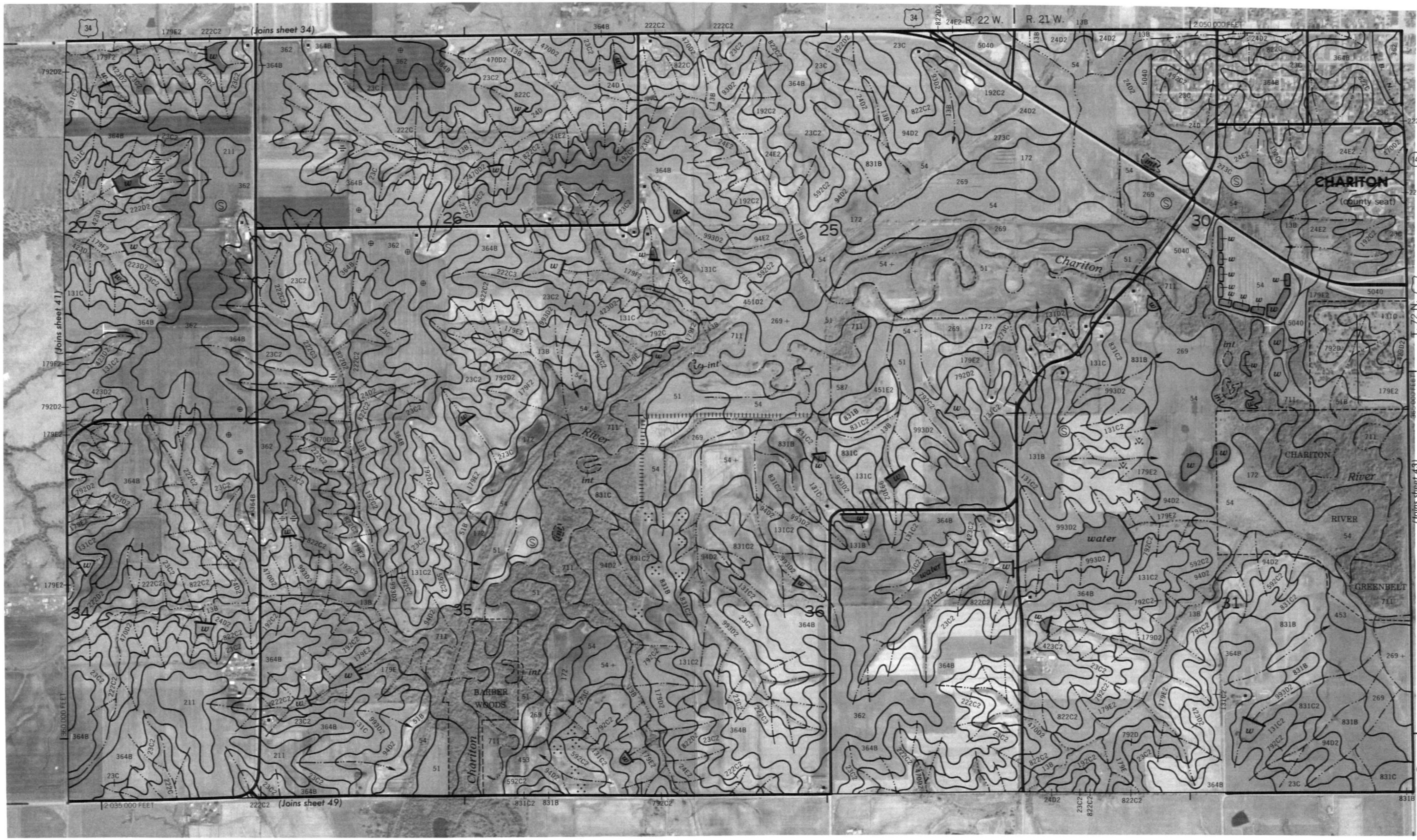
1 MILE
1 KILOMETER
SCALE 1:15 840

N

1 MILE

1 KILOMETER

SCALE 1:15 840




43
N
CHARITON
(county seat)
R. 21 W.
T. 72 N.
(Joins sheet 35)
(Joins sheet 42)
(Joins sheet 44)
(Joins sheet 50)
2 055 000 FEET
2 065 000 FEET
350 000 FEET
360 000 FEET
Lake Morris
Lake Ellis
Red Haw Lake
RED HAW STATE PARK
CHARITON RIVER
GREENBELT
BURLINGTON
CHICAGO AND NORTH WESTERN
NORTHERN
28
29
27
32
33
34
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0.5

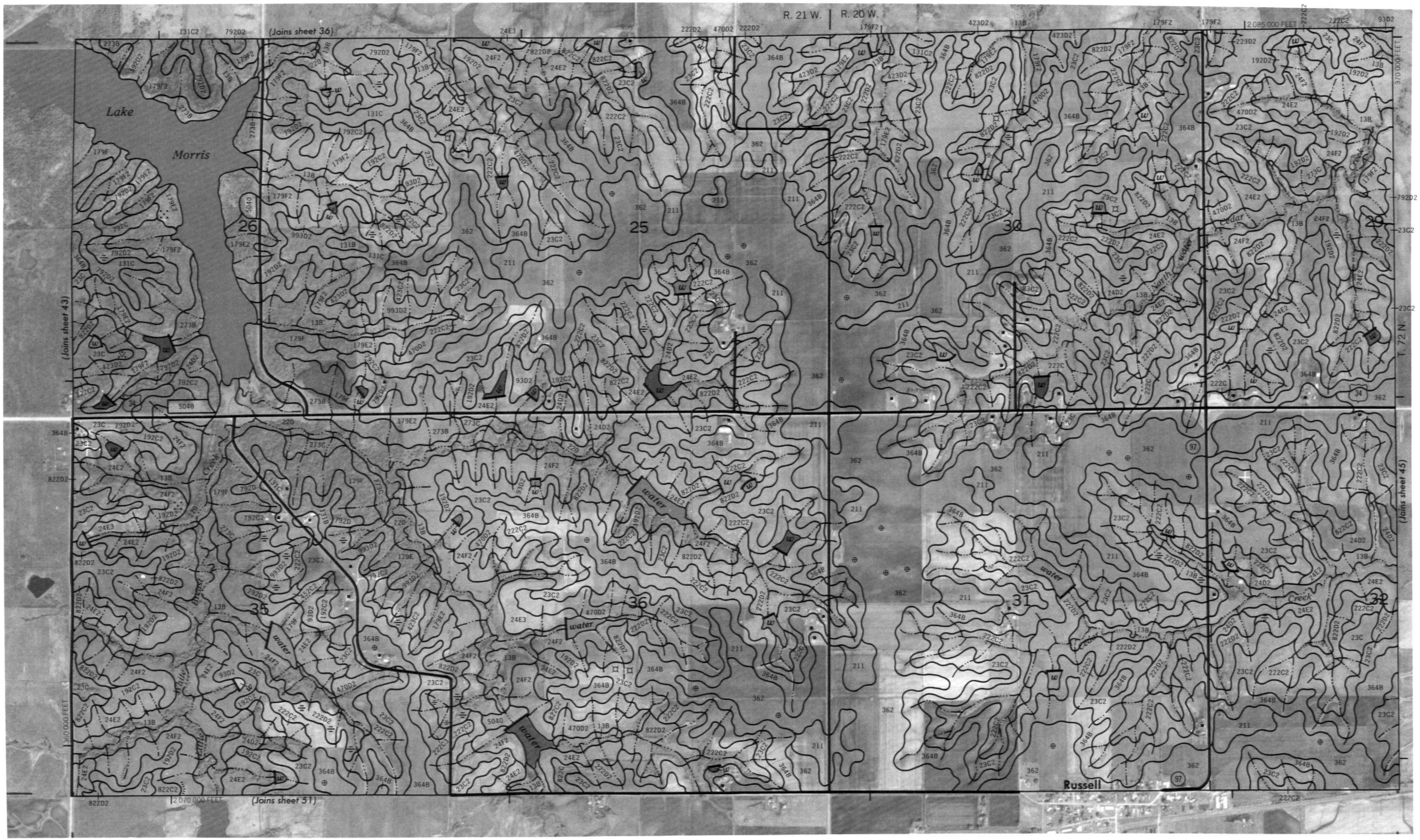
N

1 MILE

1 KILOMETER

SCALE 1:15 840

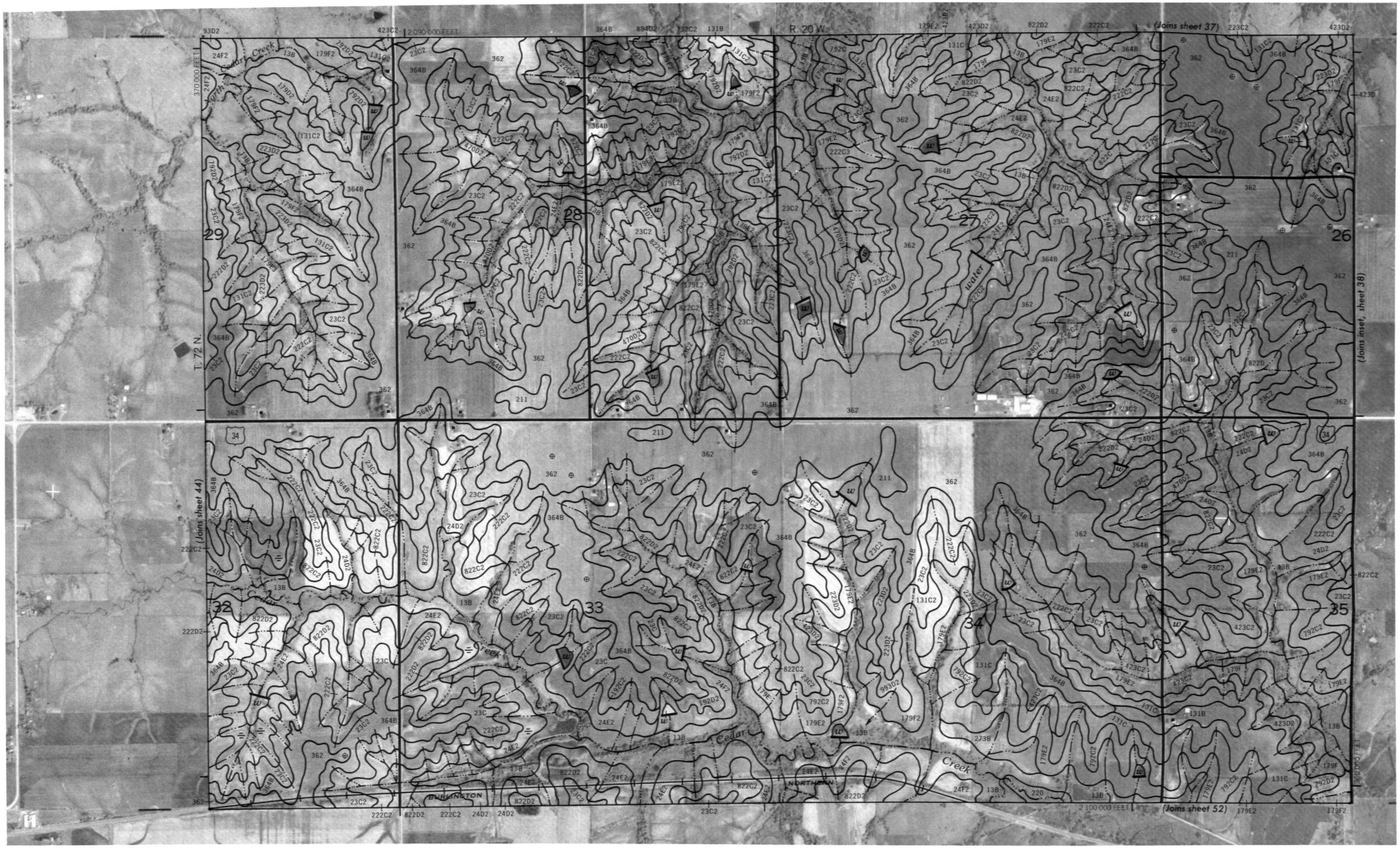
0 0 1/4 0.5 1/2 1 3/4 1

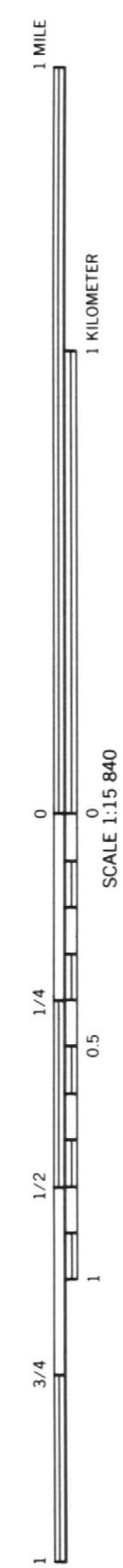


45

N

LUCAS COUNTY, IOWA NO. 45



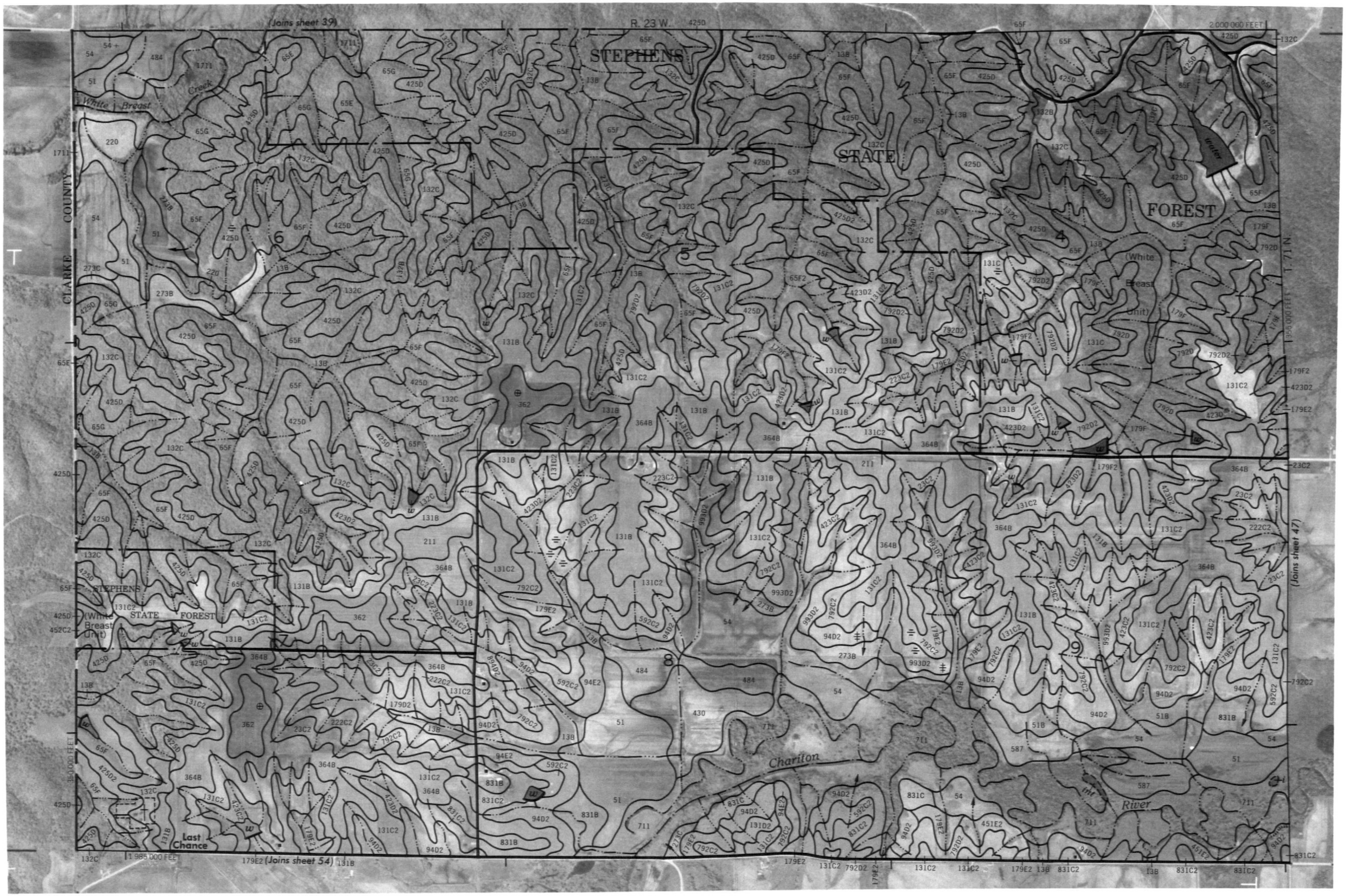


N

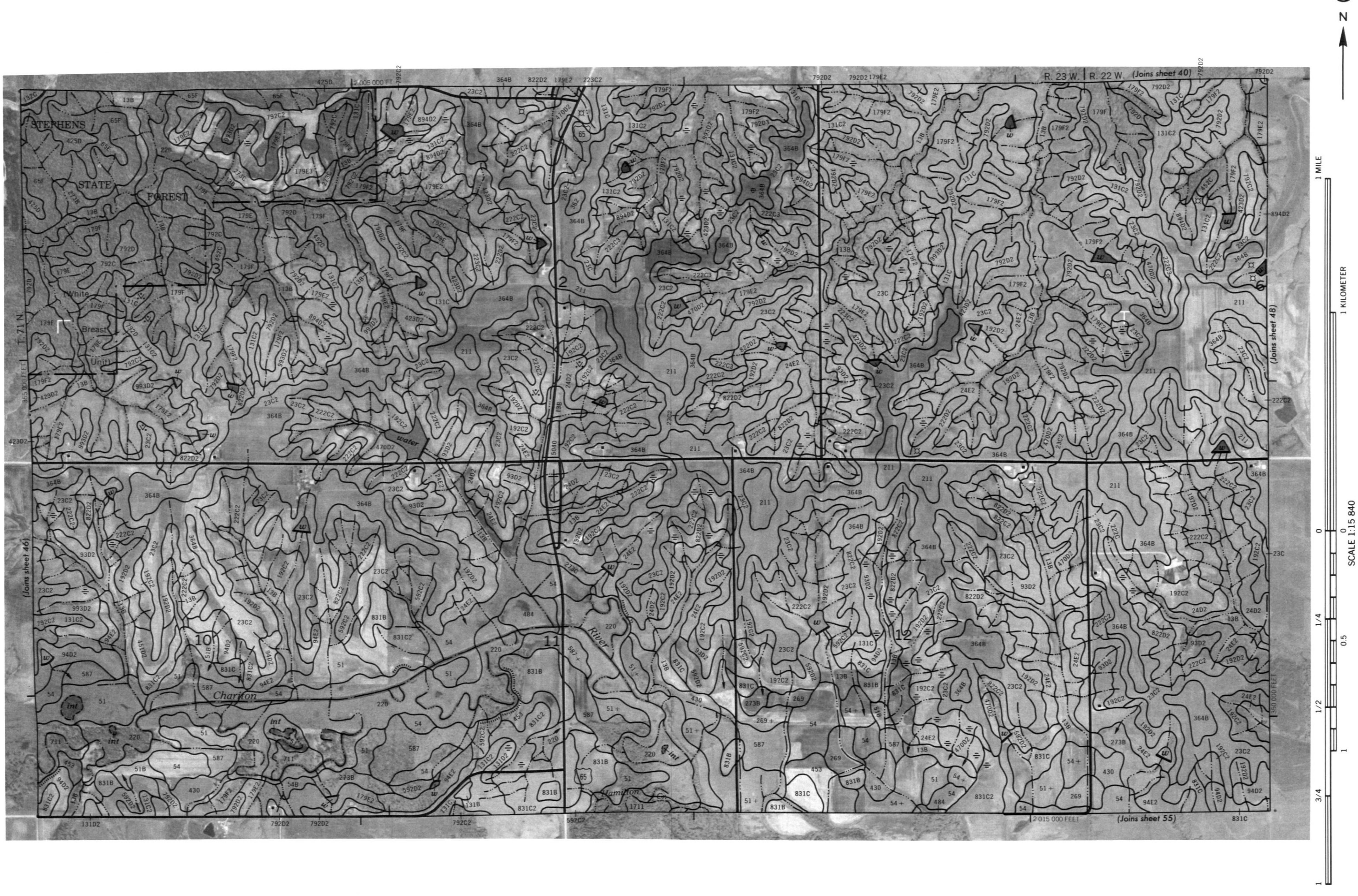
1 MILE

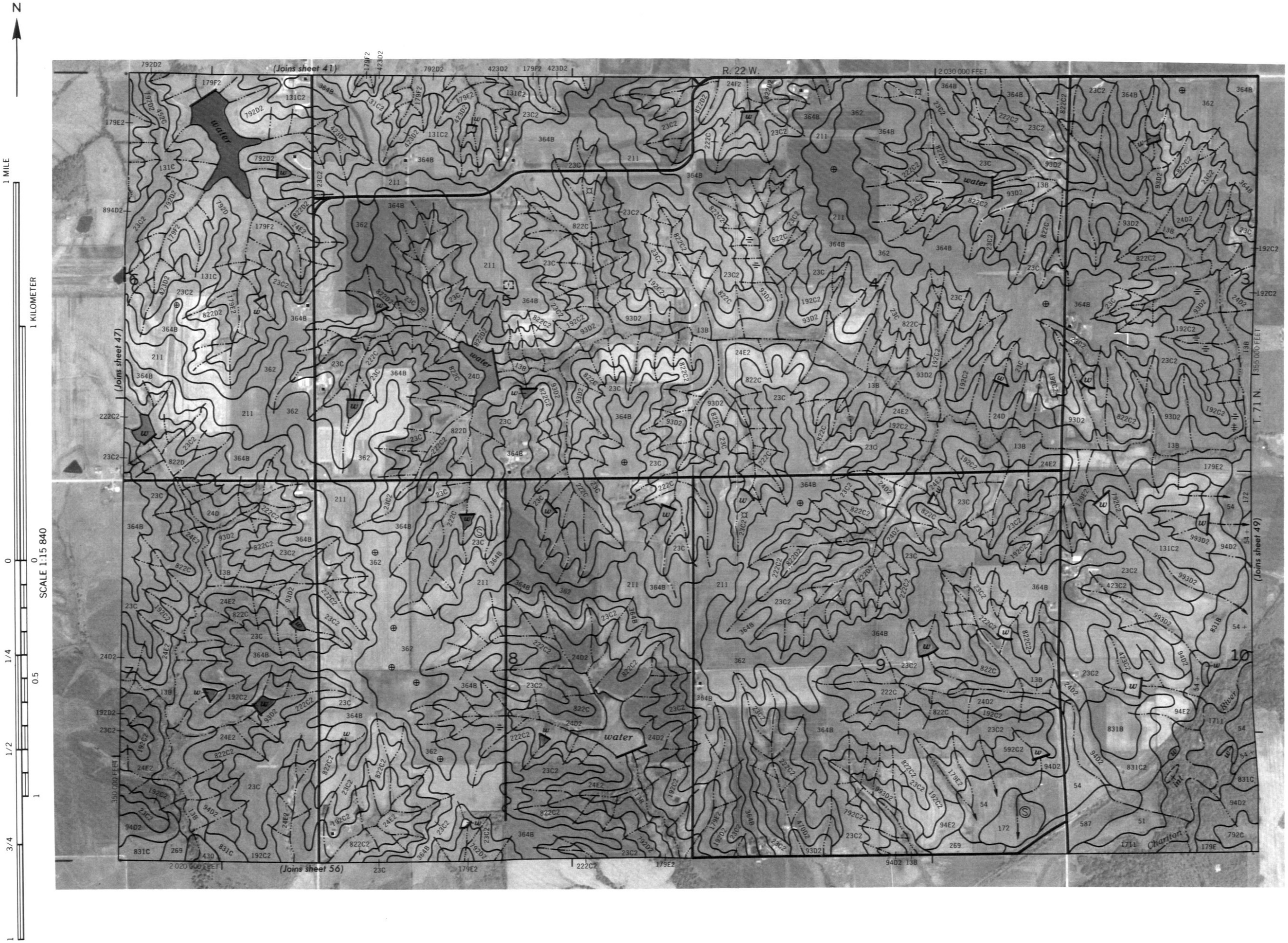
1 KILOMETER

SCALE 1:15 840



LUCAS COUNTY, IOWA NO. 47

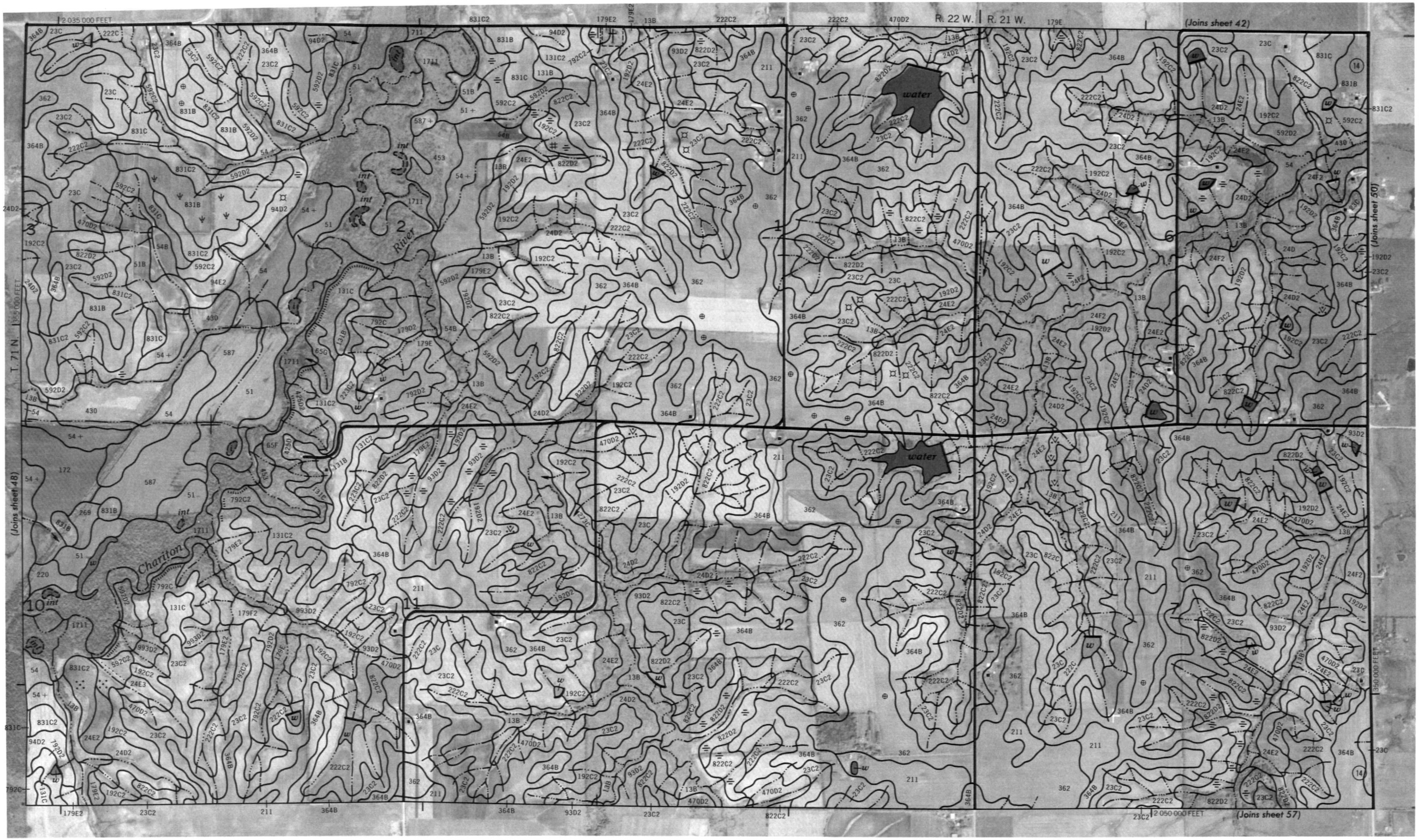



N
1 MILE
1 KILOMETER
SCALE 1:15 840
(Joins sheet 41)
(Joins sheet 47)
(Joins sheet 49)
(Joins sheet 56)
R. 22 W.
T. 71 N.
2 030 000 FEET
2 020 000 FEET
355 000 FEET
350 000 FEET
water
Charlton
River

49

N

LUCAS COUNTY, IOWA NO. 49



1 MILE

1 KILOMETER

SCALE 1:15 840

0

1/4

1/2

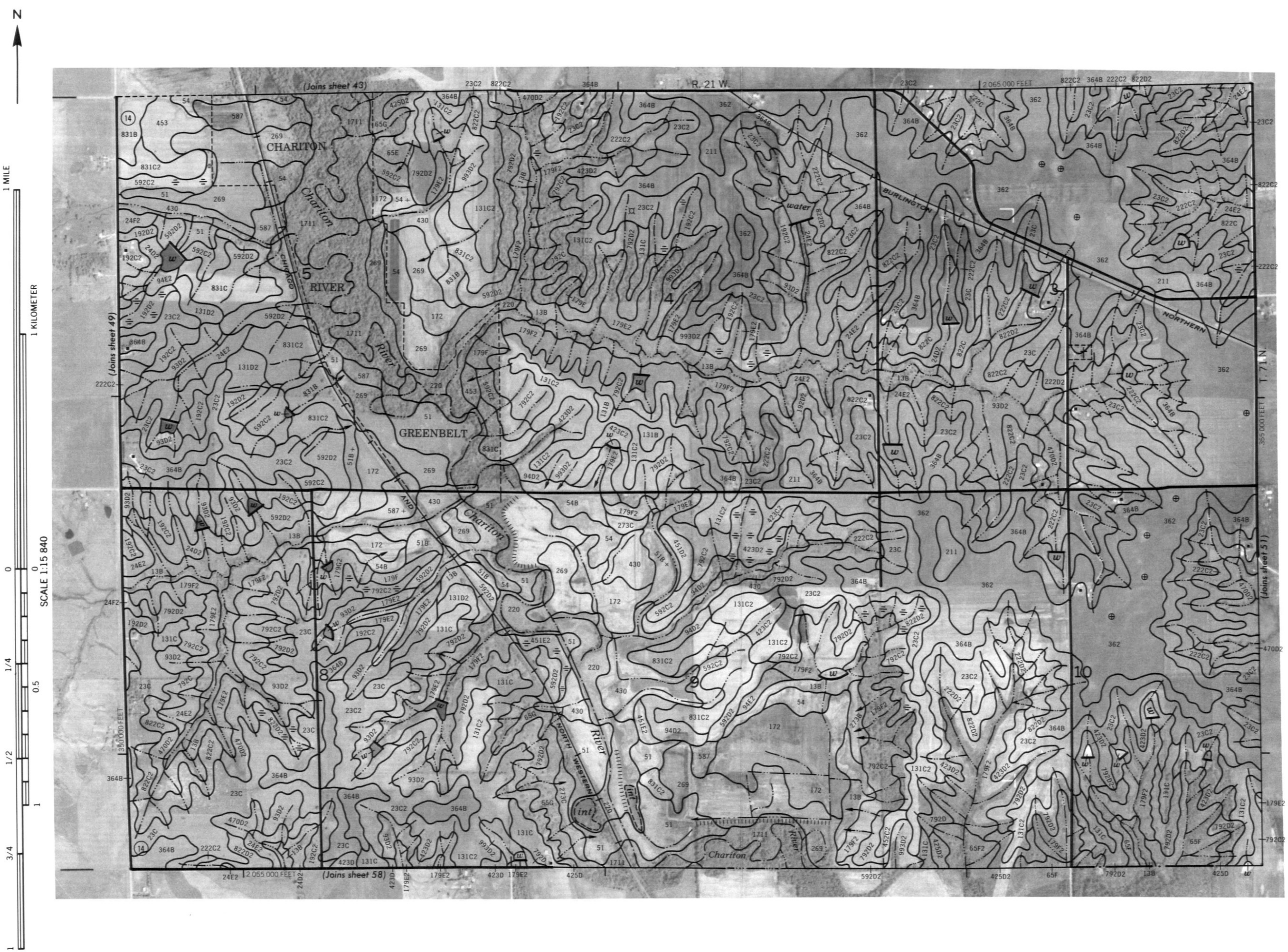
3/4

1

0

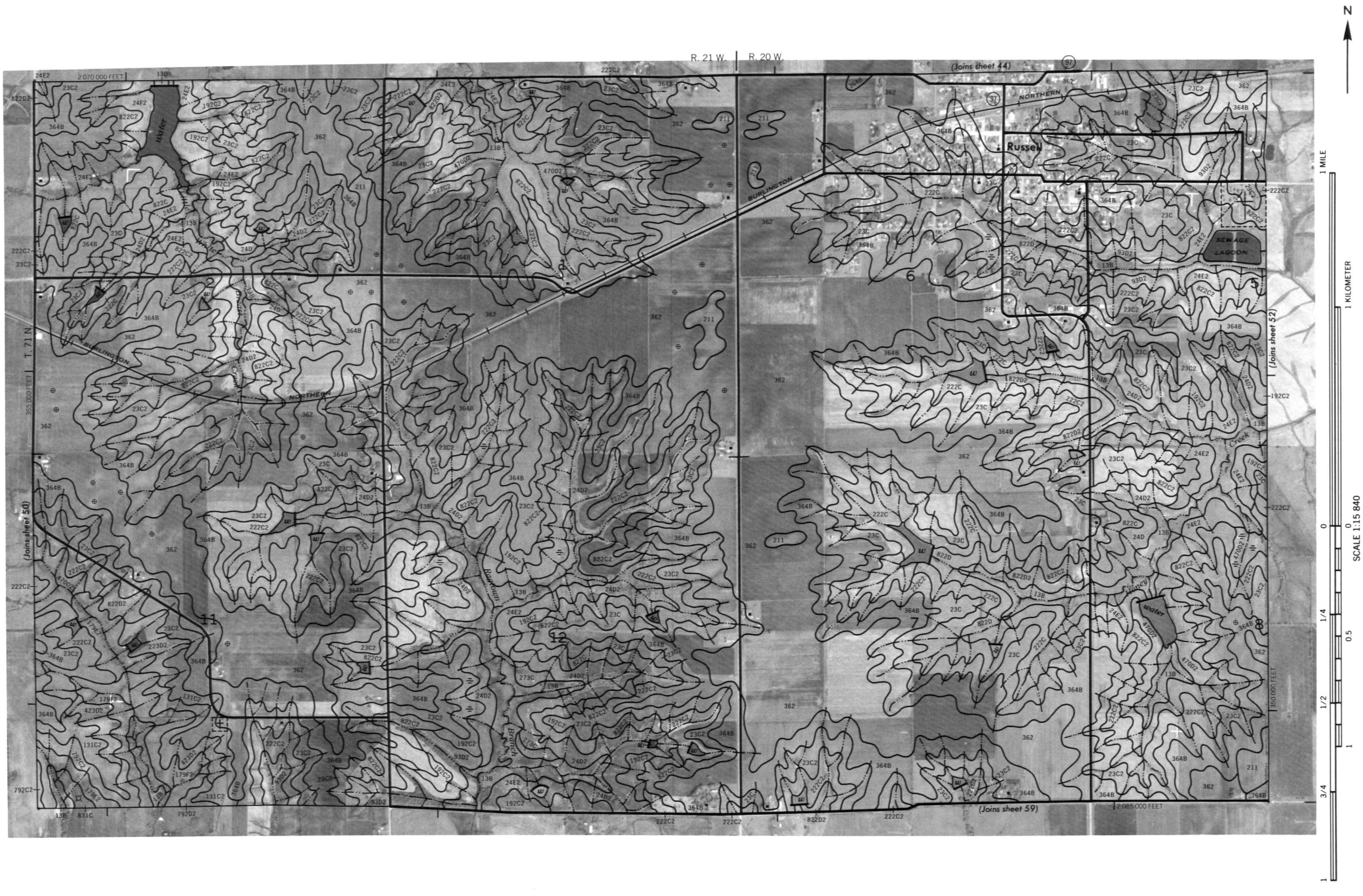
0.5

1



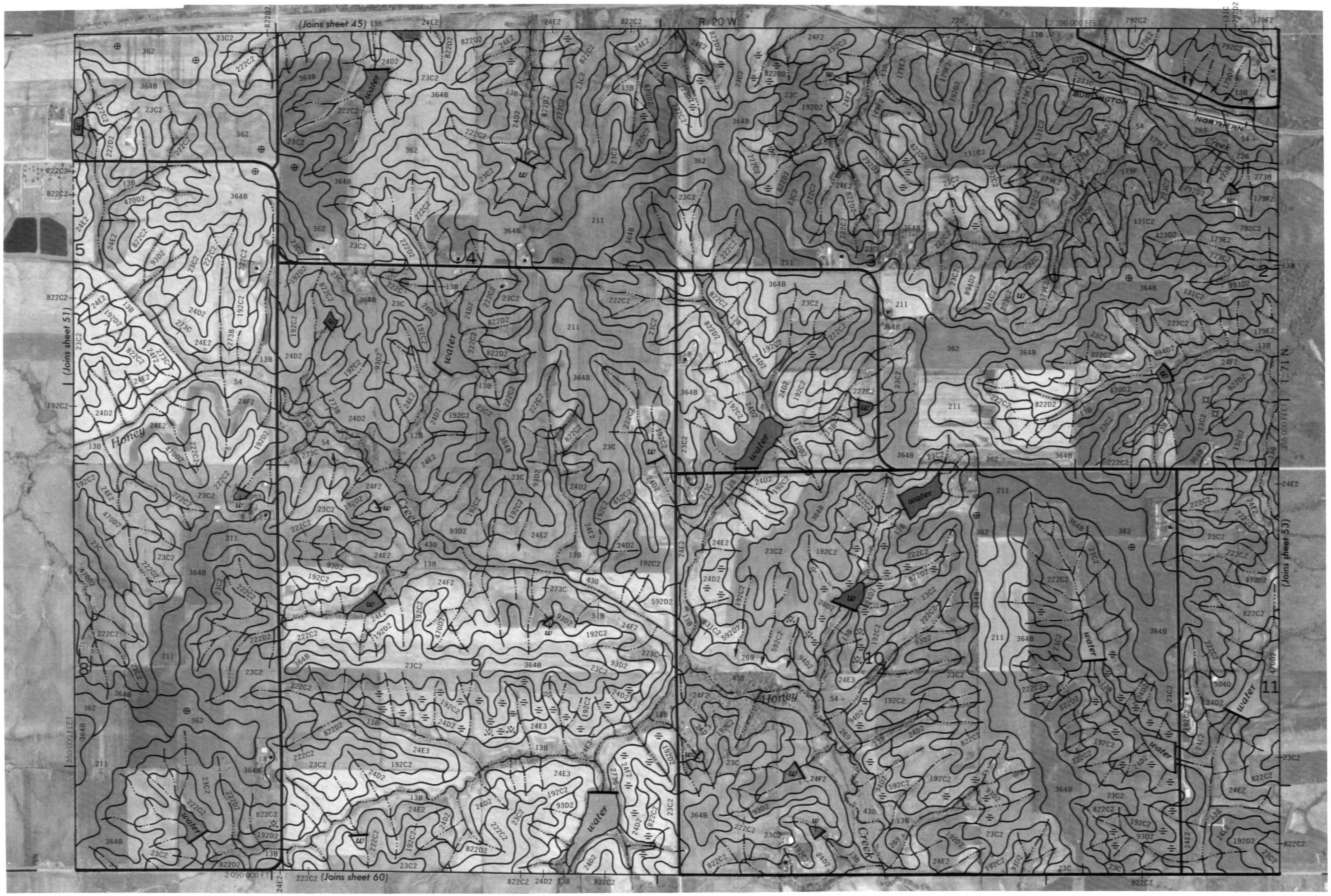
LUCAS COUNTY, IOWA NO. 50

51

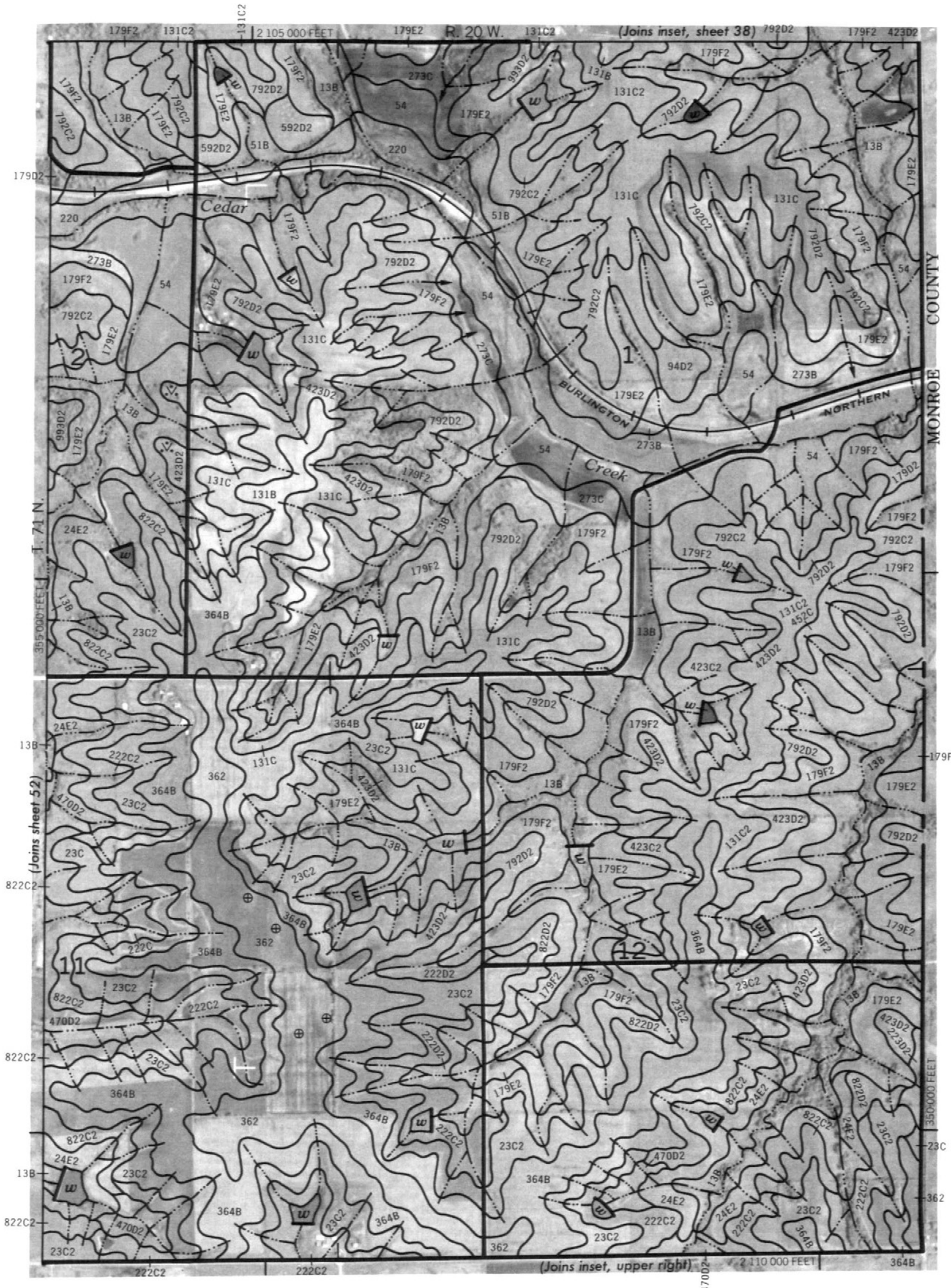

N
R. 21 W.
R. 20 W.
T. 71 N.
(Joins sheet 44)
(Joins sheet 52)
(Joins sheet 59)
(Joins sheet 50)
Russell
SEWAGE LAGOON
NORTHERN
BURLINGTON
water
Branch
Creek
2 070 000 FEET
2 085 000 FEET
350 000 FEET
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0.5

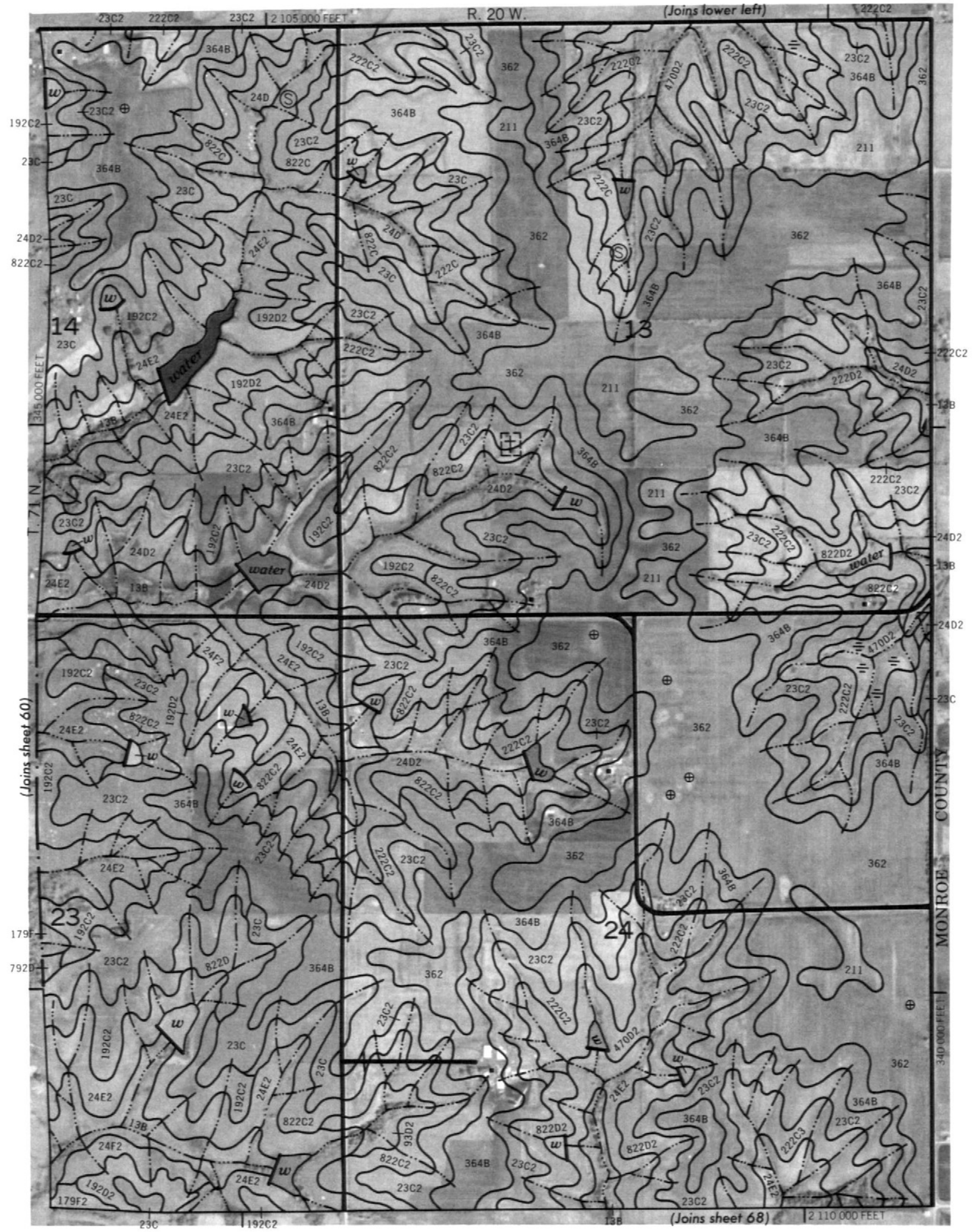
N

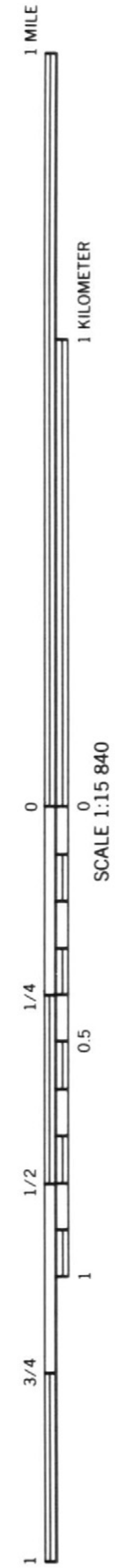

1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1


(Joins sheet 45)
R. 20 W.
T. 71 N.
(Joins sheet 51)
(Joins sheet 53)
(Joins sheet 60)
2 100 000 FEET
2 090 000 FEET
350 000 FEET
355 000 FEET
BURLINGTON
NORTHERN
Honey
Creek
water
2
3
4
5
8
9
10
11

N







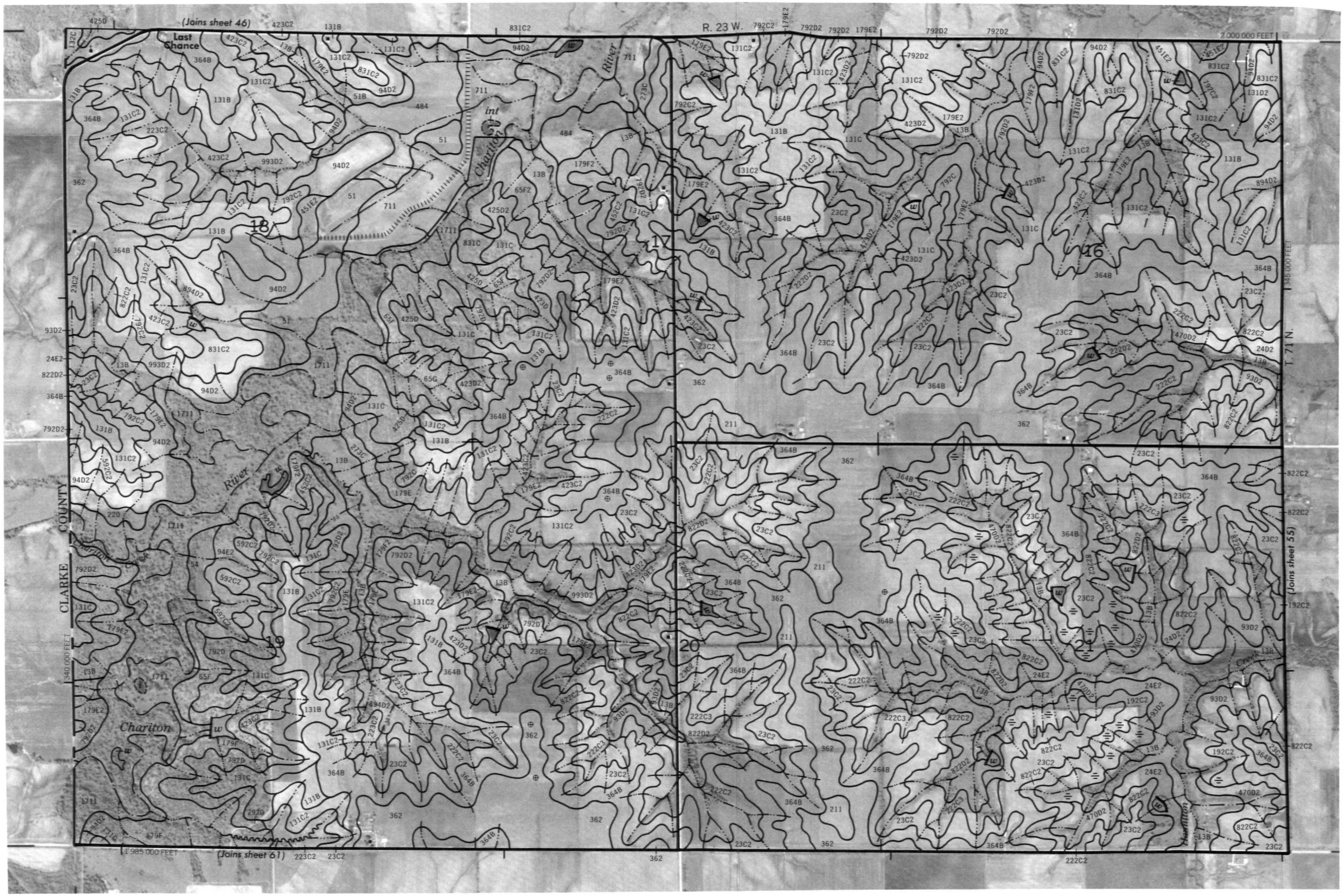
LUCAS COUNTY, IOWA NO. 53

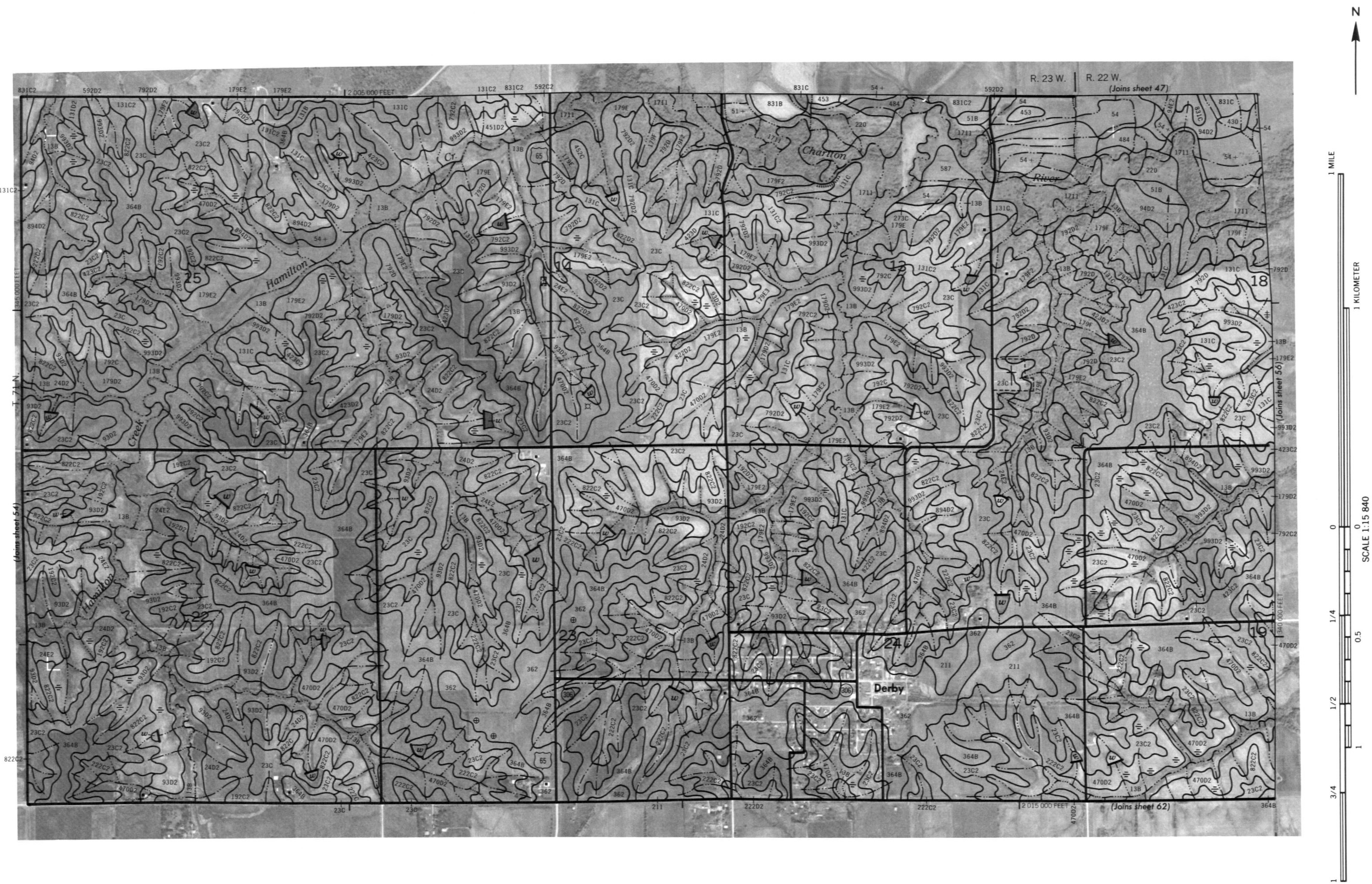
N

1 MILE

1 KILOMETER

SCALE 1:15 840



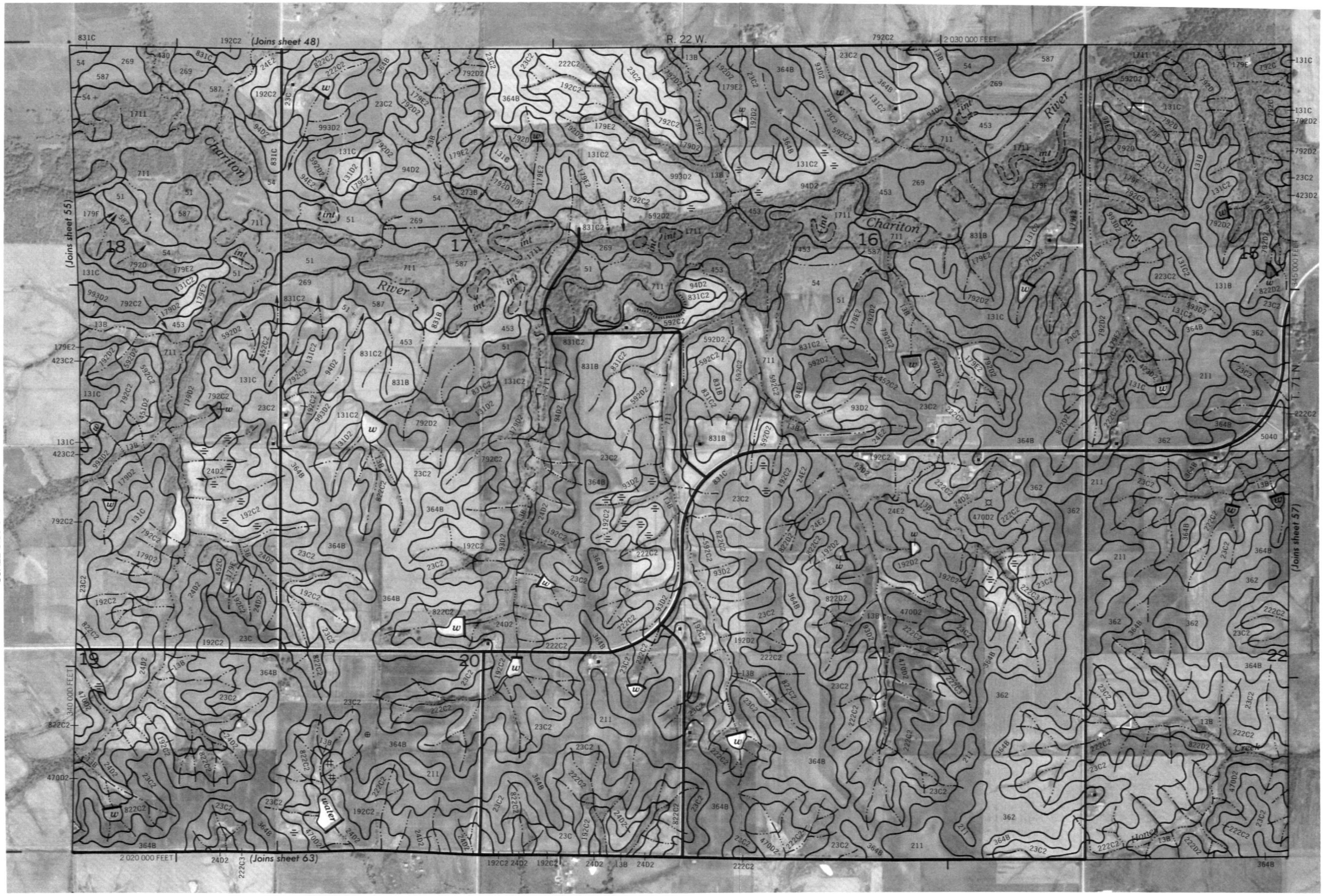

55
N
R. 23 W.
R. 22 W.
(Joins sheet 47)
(Joins sheet 54)
(Joins sheet 56)
(Joins sheet 62)
T. 71 N.
2 005 000 FEET
2 015 000 FEET
345 000 FEET
340 000 FEET
Hamilton
Creek
Cr.
Chariton
River
Derby
65
306
13
14
18
19
22
23
24
25
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0.5

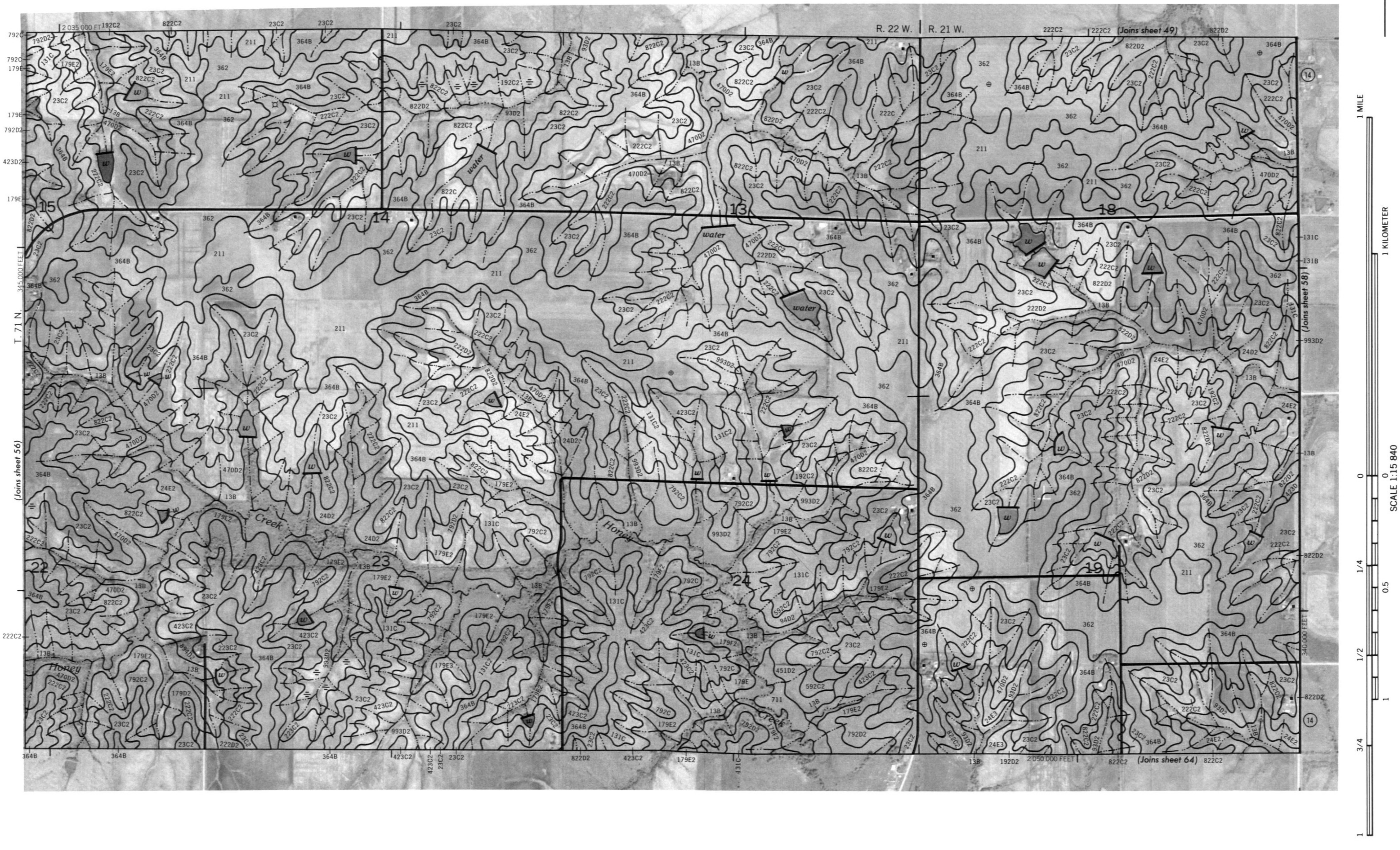
N

SCALE 1:15 840

1 MILE

1 KILOMETER





LUCAS COUNTY, IOWA NO. 57

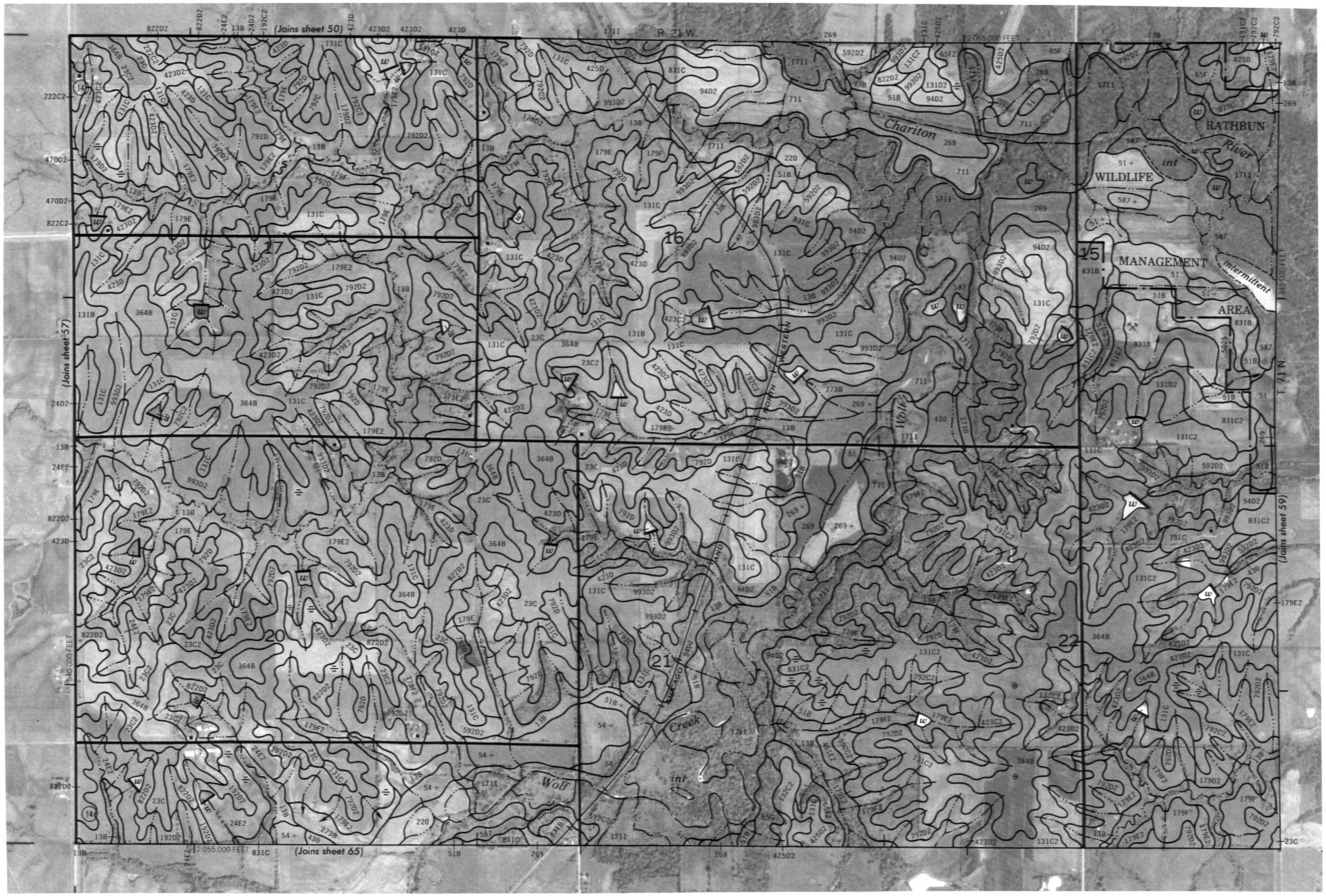
N

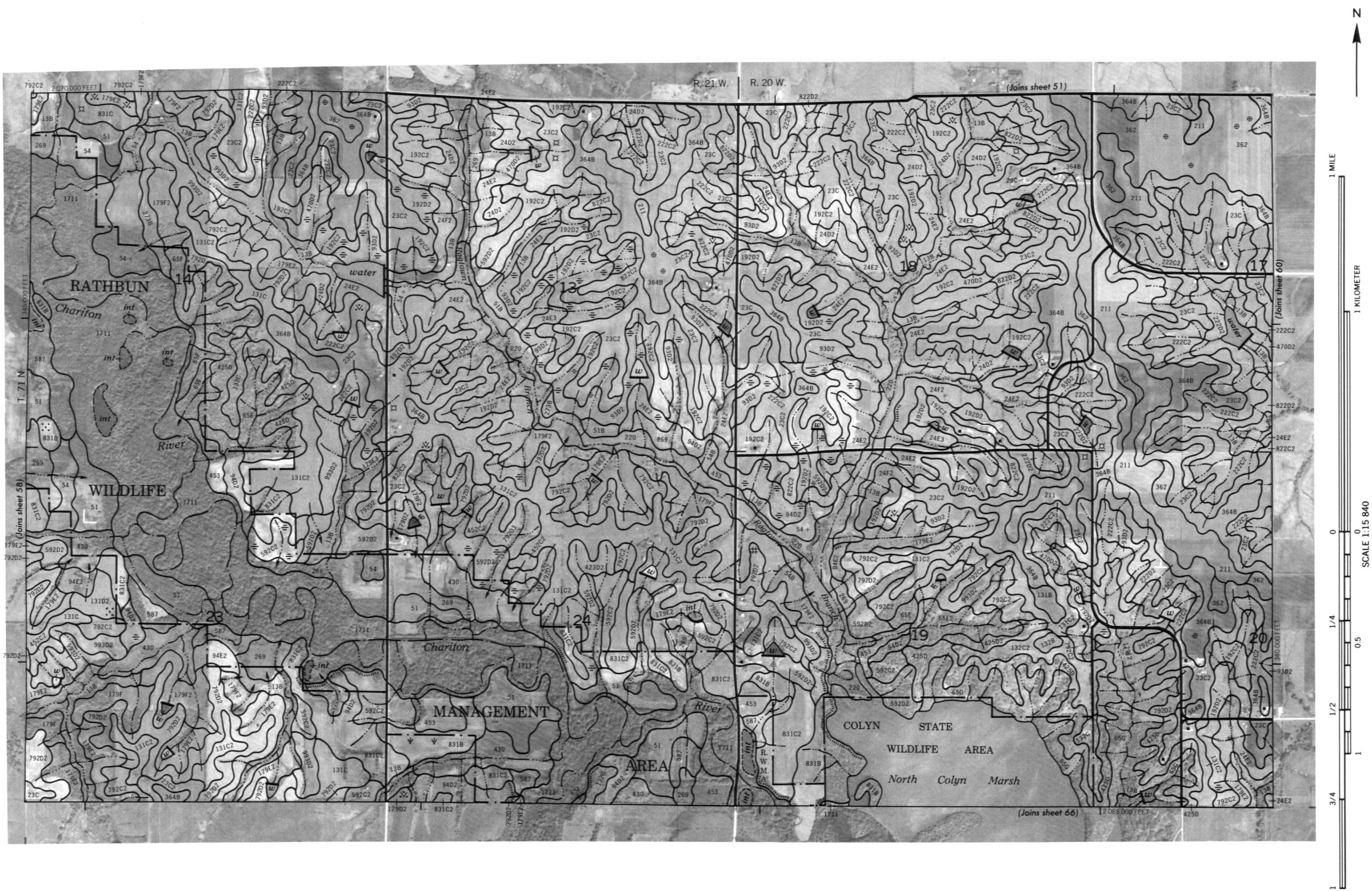
1 MILE

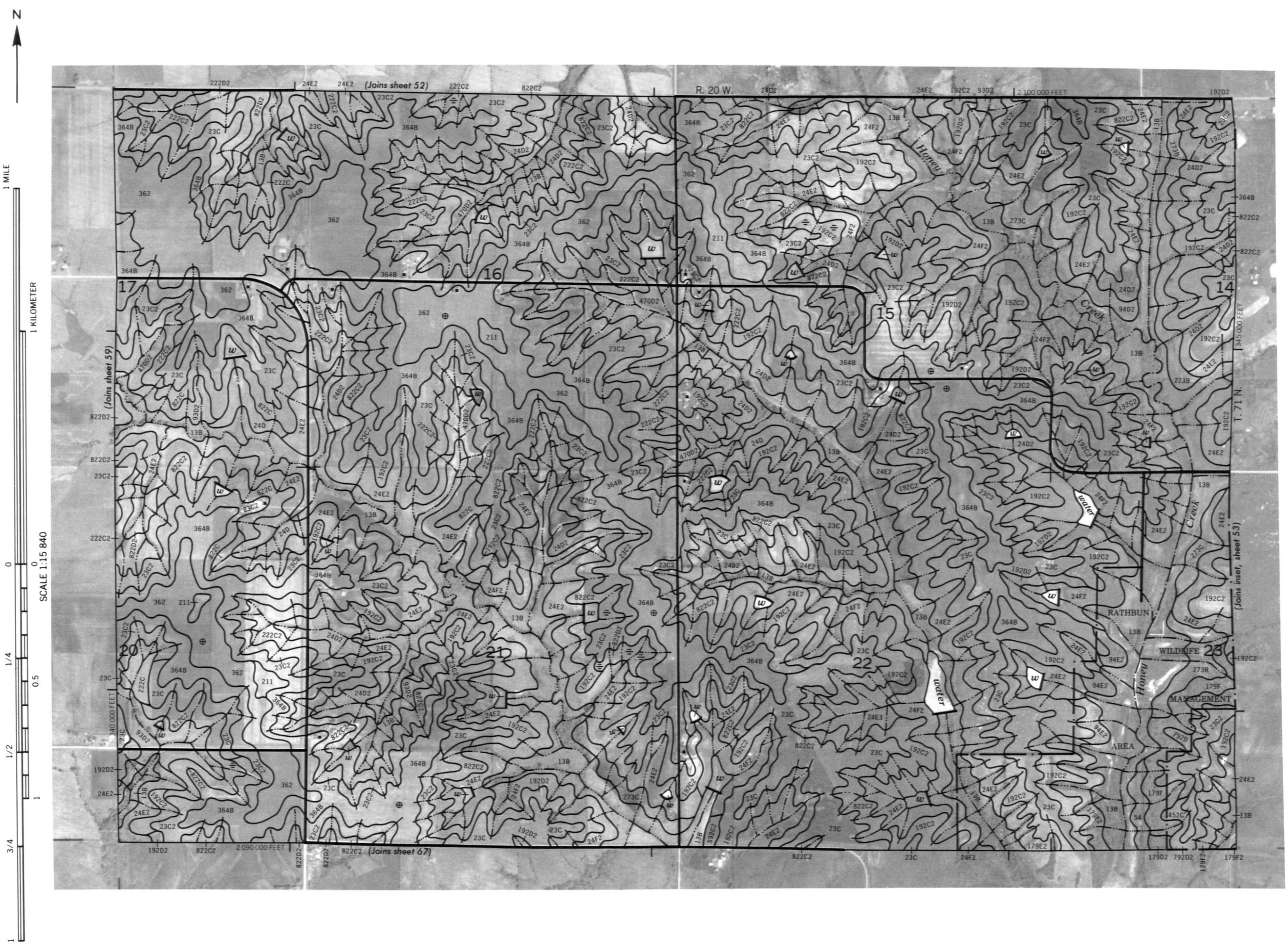
1 KILOMETER

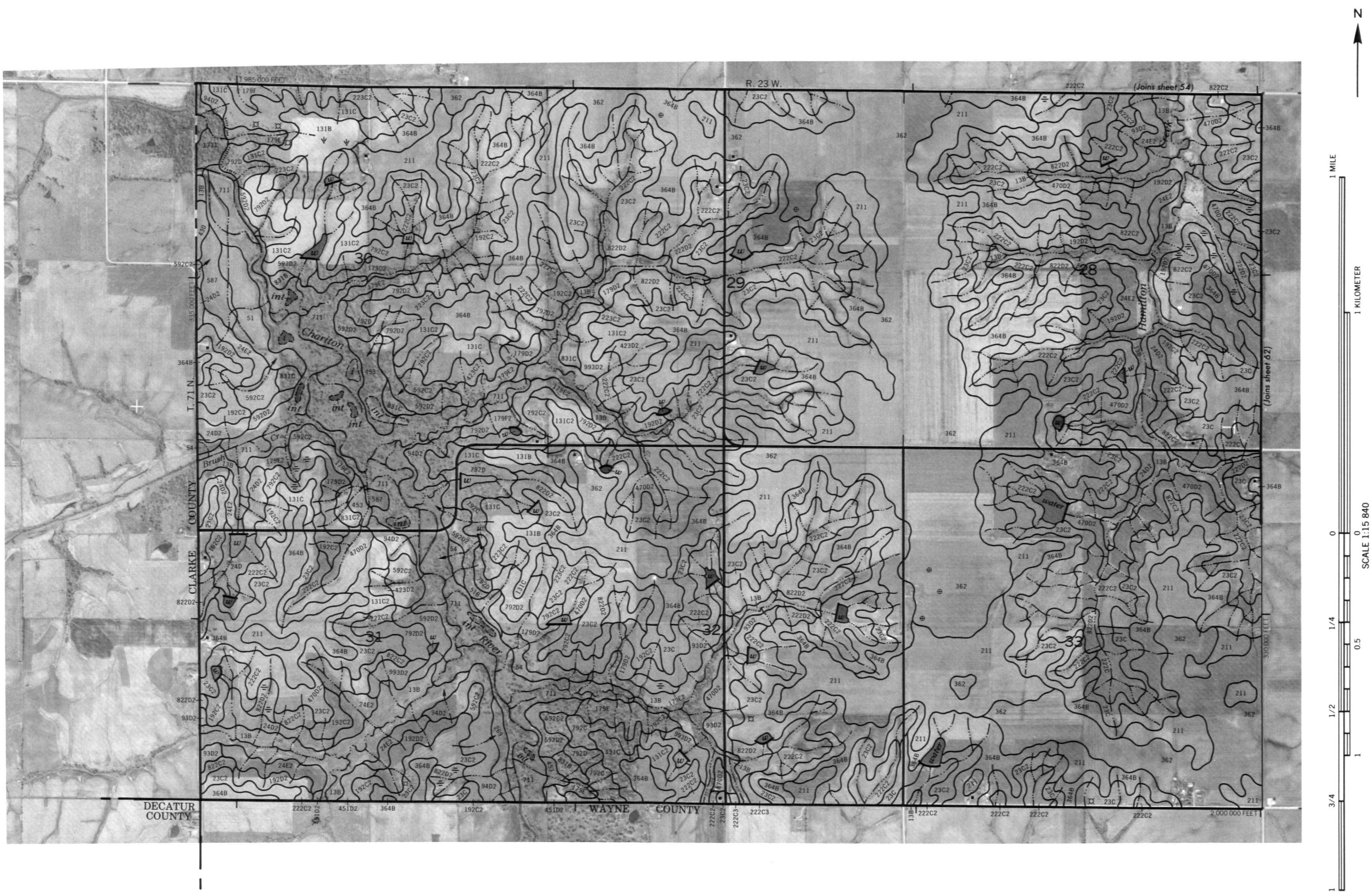
SCALE 1:15 840

0 0 1/4 0.5 1/2 1 3/4 1



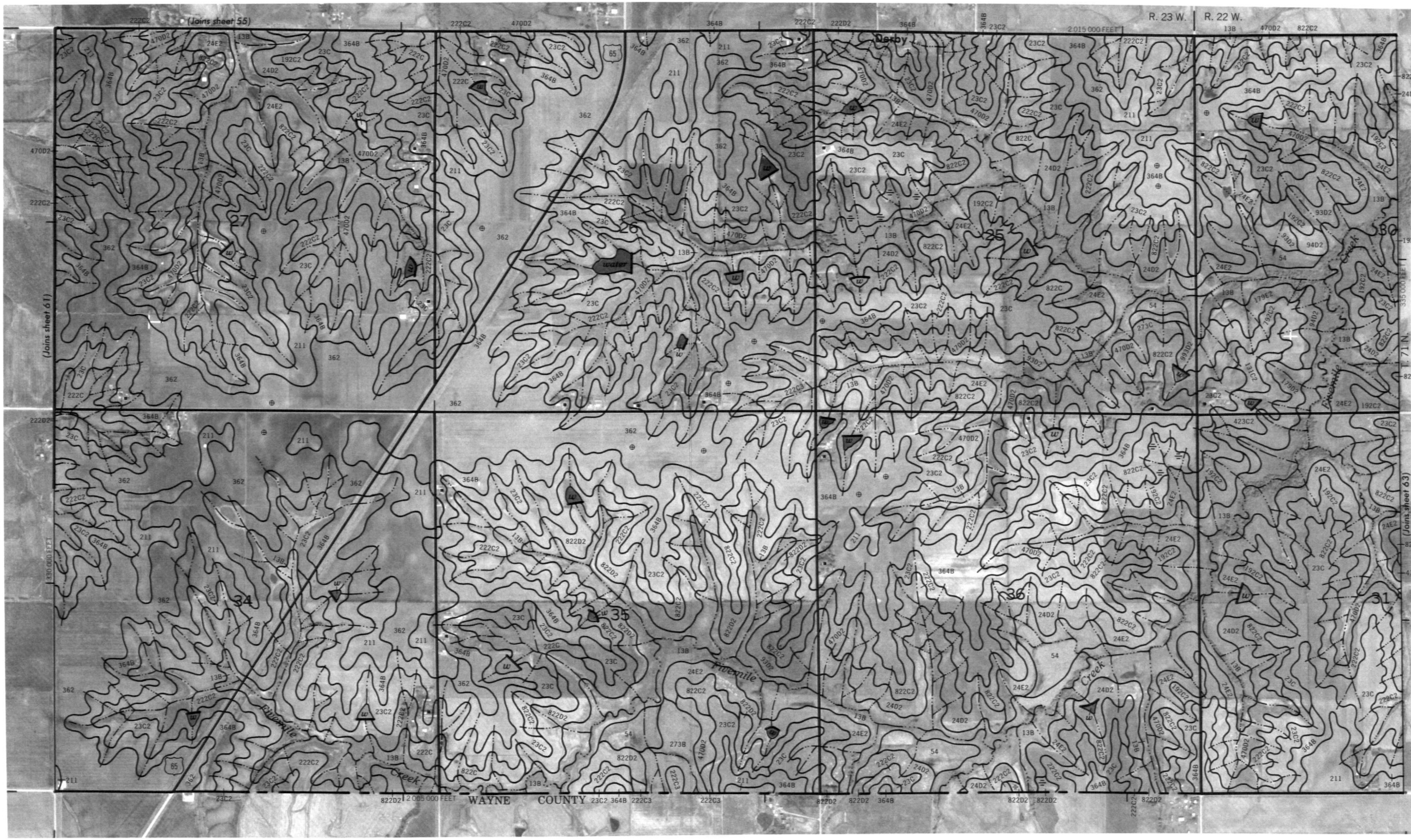

59
N
R. 21 W.
R. 20 W.
(Joins sheet 51)
(Joins sheet 60)
(Joins sheet 66)
(Joins sheet 58)
T. 71 N.
2 070 000 FEET
2 085 000 FEET
340 000 FEET
RATHBUN
WILDLIFE
MANAGEMENT
AREA
Chariton
River
Ragtown
Branch
COLYN STATE
WILDLIFE AREA
North Colyn Marsh
water
R. W. M. A.
13
14
17
18
19
20
23
24
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0.5


N
1 MILE
1 KILOMETER
SCALE 1:15 840
(Joins sheet 52)
(Joins sheet 59)
(Joins sheet 67)
(Joins inset, sheet 53)
R. 20 W.
T. 71 N.
2 100 000 FEET
345 000 FEET
340 000 FEET
2 090 000 FEET
16
17
15
14
20
21
22
23
Honey Creek
water
RATHBUN WILDLIFE MANAGEMENT AREA



LUCAS COUNTY, IOWA NO. 61

N

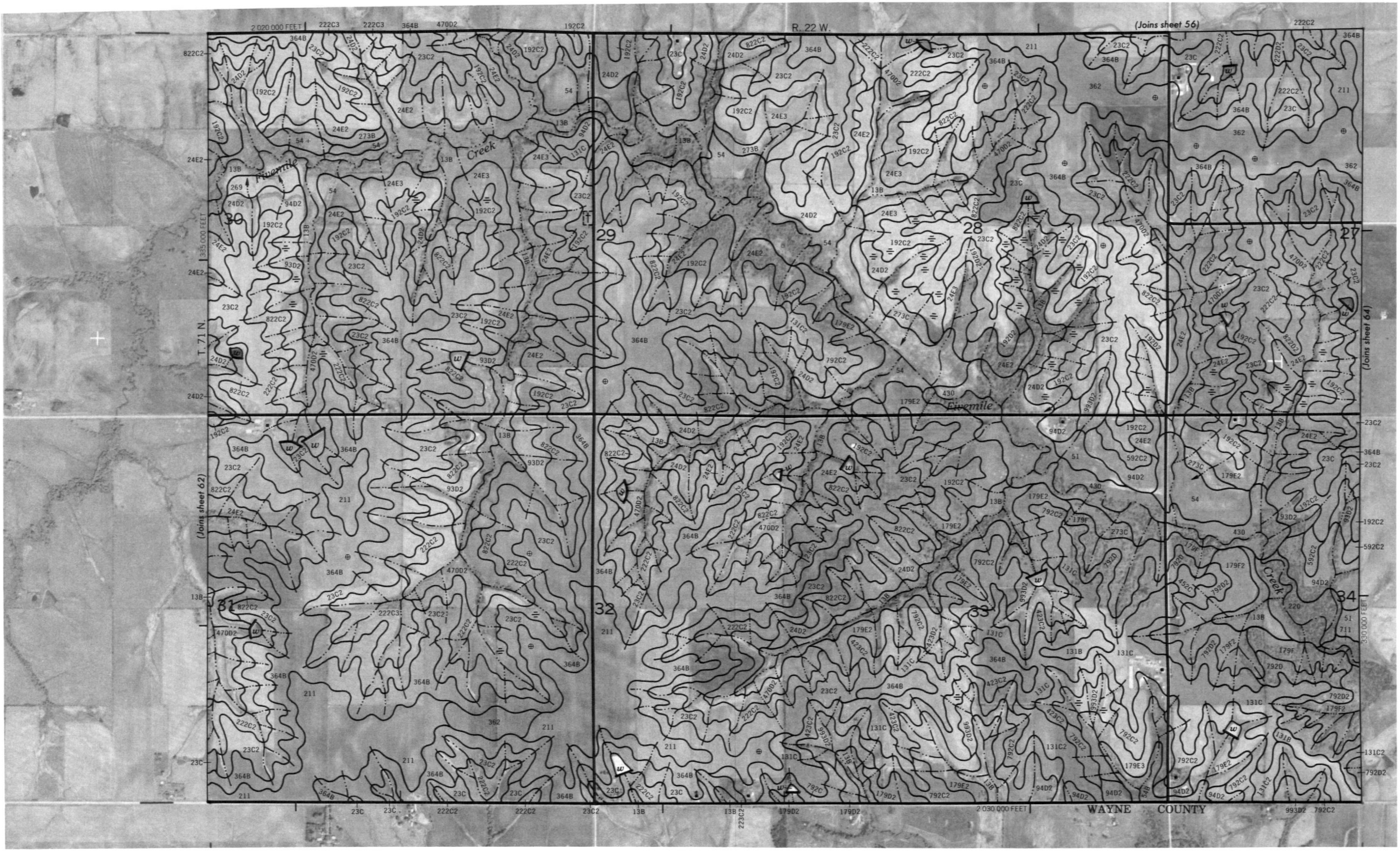


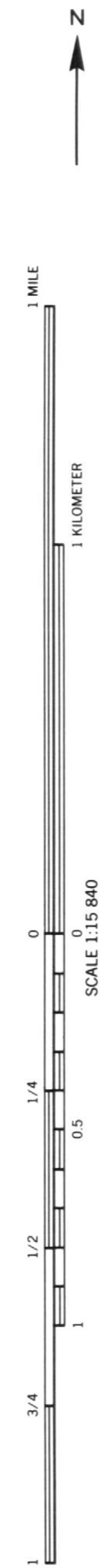
1 MILE

1 KILOMETER

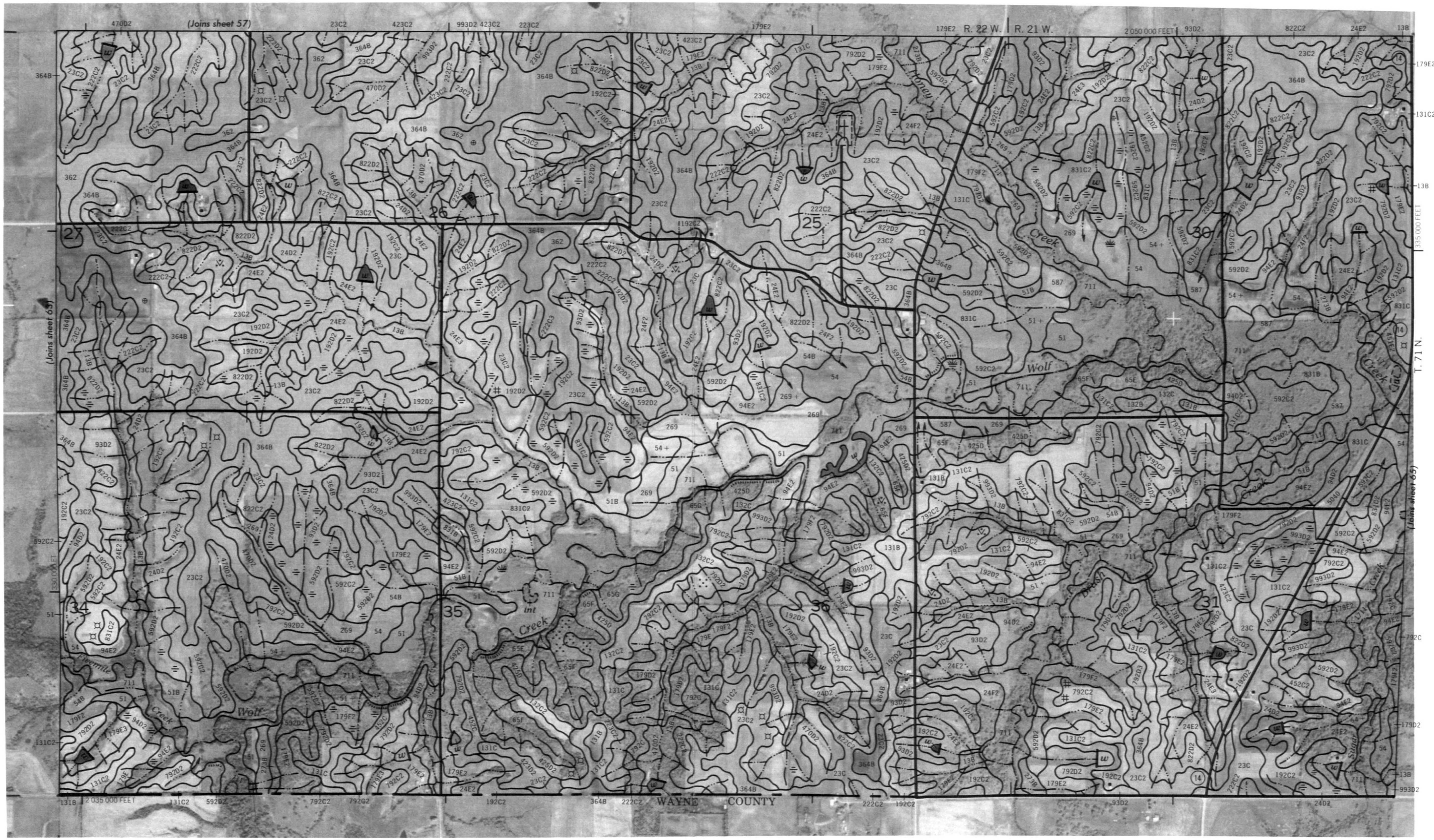
SCALE 1:15 840

0 0 1/4 0.5 1/2 1 3/4 1


(Joins sheet 56)
(Joins sheet 64)
(Joins sheet 62)
R. 22 W.
T. 71 N.
2 020 000 FEET
2 030 000 FEET
335 000 FEET
330 000 FEET
Fivemile Creek
Fivemile
Creek
WAYNE COUNTY
29
30
27
28
31
32
33
34

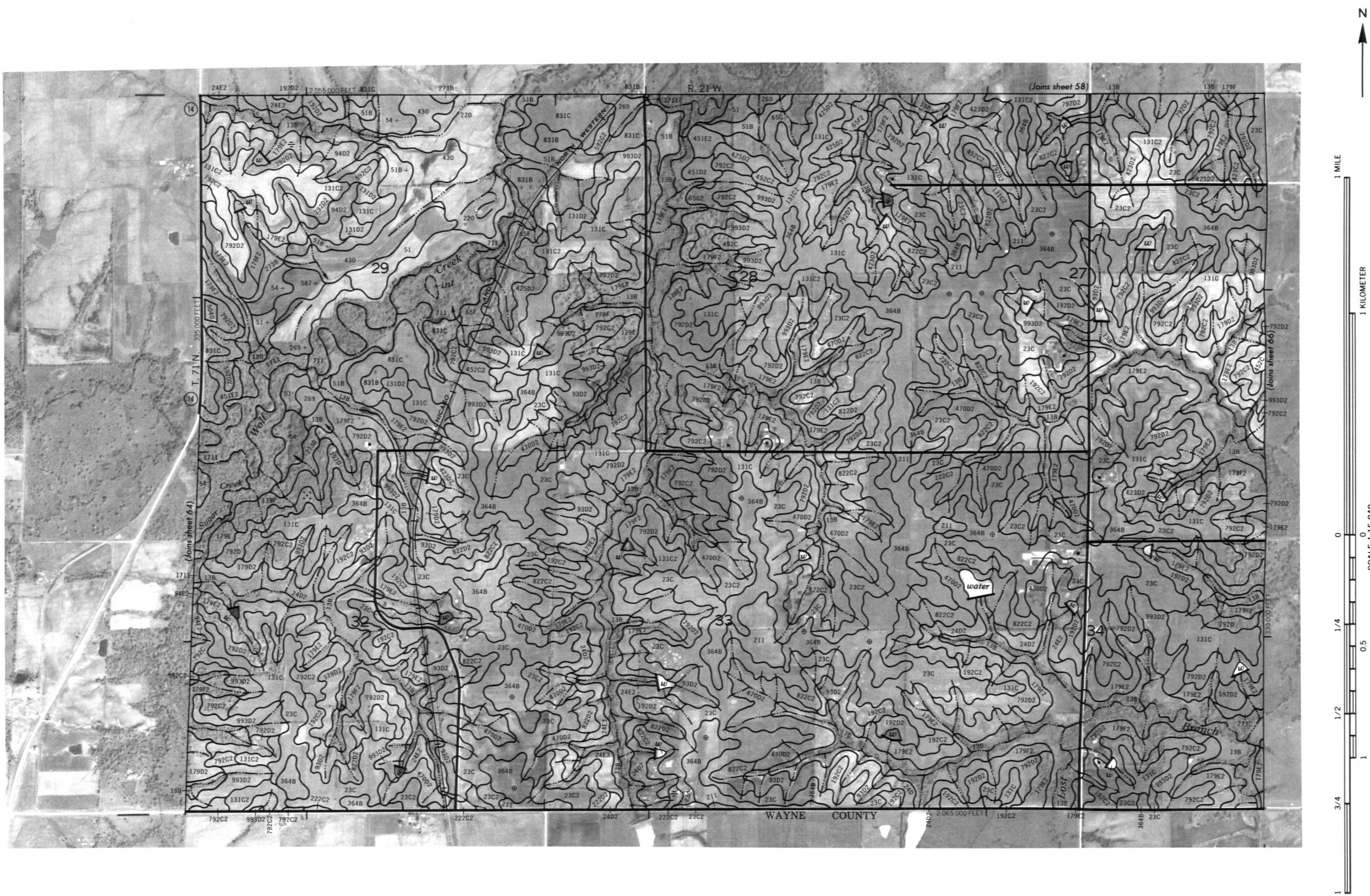

N
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1

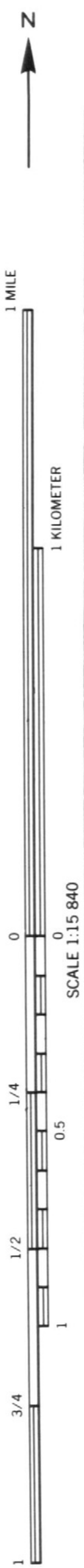
N

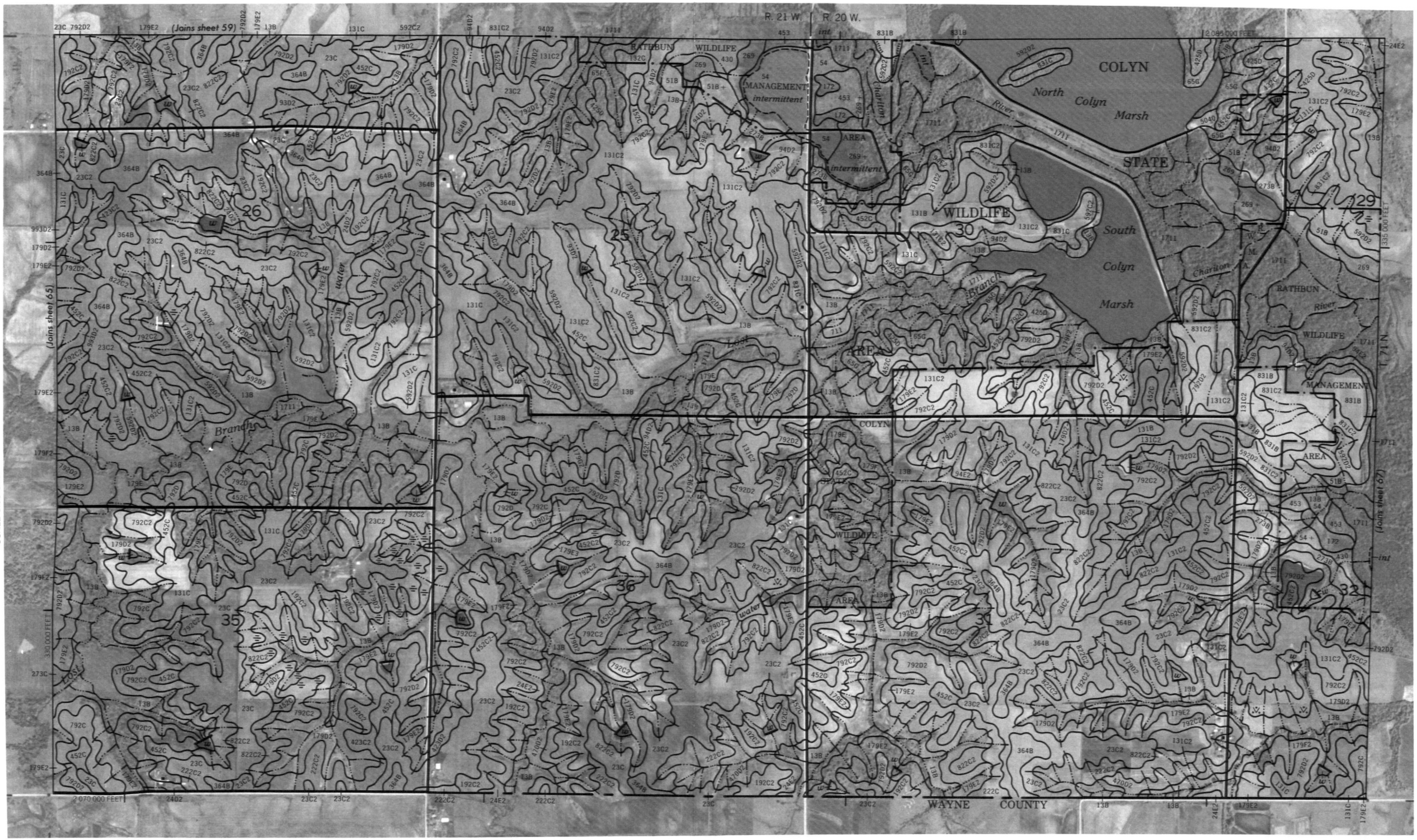


1 MILE
1 KILOMETER
SCALE 1:15 840
0
0
1/4
0.5
1/2
1
3/4
1

LUCAS COUNTY, IOWA NO. 64

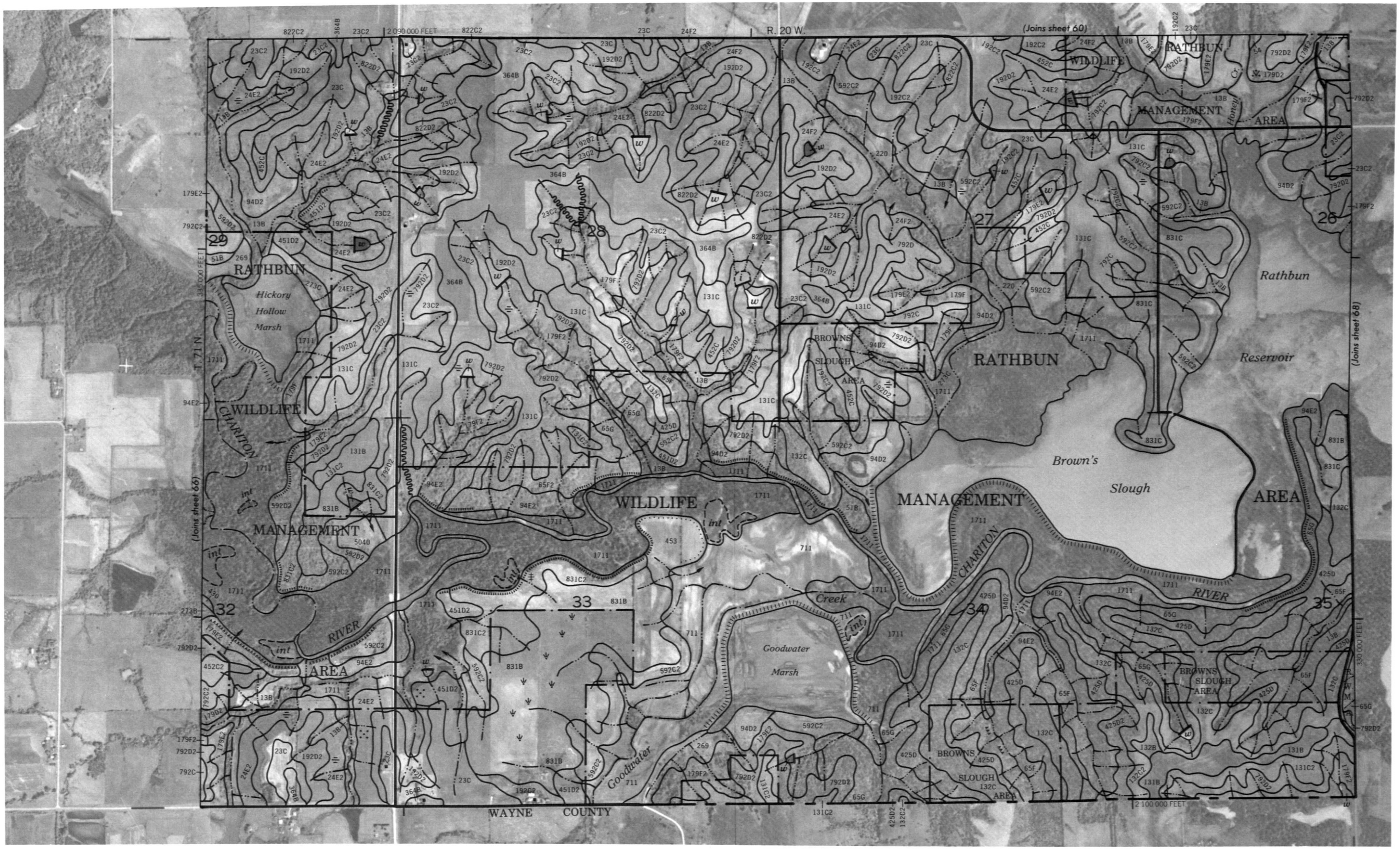

N
(Joins sheet 58)
(Joins sheet 66)
(Joins sheet 64)
R. 21 W.
T. 71 N.
2 055 000 FEET
2 065 000 FEET
335 000 FEET
330 000 FEET
CHICAGO AND NORTH WESTERN
WAYNE COUNTY
Wolf Creek
Sugar Creek
Lost
Branch
water
29
28
27
32
33
34
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0.5


N
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1


(Joins sheet 59)
(Joins sheet 65)
(Joins sheet 67)
R. 21 W.
R. 20 W.
T. 71 N.
2 085 000 FEET
2 070 000 FEET
335 000 FEET
330 000 FEET
RATHBUN WILDLIFE MANAGEMENT AREA
COLYN
North Colyn Marsh
South Colyn Marsh
STATE
WILDLIFE
AREA
Chariton River
Little Branch
Branch
water
intermittent
26
25
30
29
35
36
31
32
WAYNE COUNTY

67

N



SCALE 1:15 840

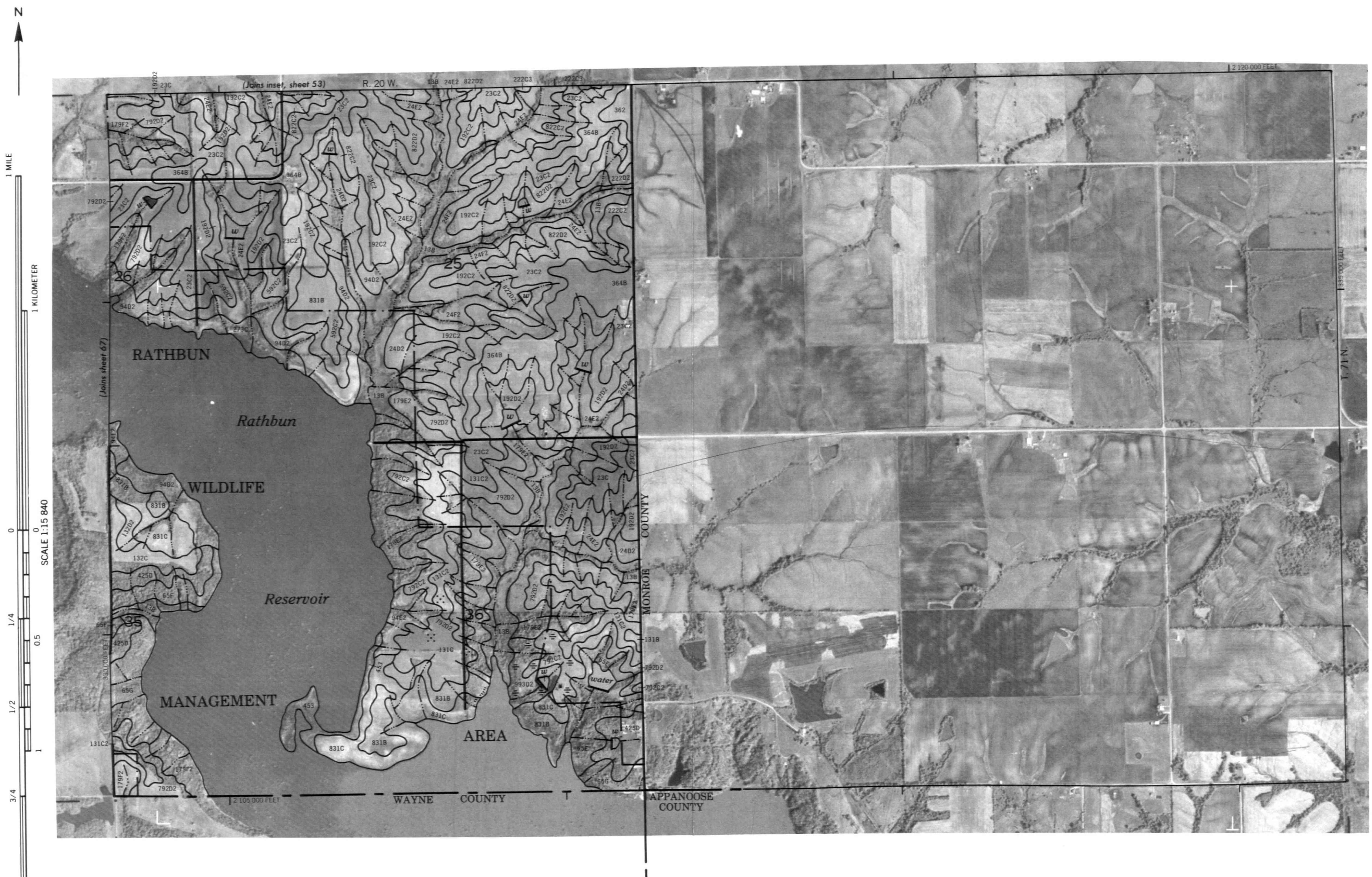
1 MILE

1 KILOMETER

0 1/4 1/2 3/4 1

0 0.5 1

LUCAS COUNTY, IOWA NO. 67


68
N
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1
(Joins inset, sheet 53)
R. 20 W.
(Joins sheet 67)
RATHBUN
Rathbun
WILDLIFE
Reservoir
MANAGEMENT
AREA
WAYNE COUNTY
APPANOOSE COUNTY
MONROE COUNTY
2 120 000 FEET
2 105 000 FEET
T. 71 N.
25
26
35
36
water